# HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS



***Editorial Staff***

Editor
CLIFFORD STROCK

Associate Editors
NATHAN N. WOLPERT
WILLIAM B. FOXHALL

Technical Consultant
T. W. REYNOLDS

***Advertising Staff***

Chicago
GEORGE G. TURNER
228 North La Salle Street.

New York
HARRY J. TWINE
148 Lafayette Street.

Cleveland
EDWARD B. McENTEE
17115 Hillsboro Road.

Los Angeles
ROBERT H. DEIBLER
2506 W. 8th Street.



***Published Monthly by***

THE INDUSTRIAL PRESS
148 Lafayette Street
New York 13, N. Y.

President
ROBERT B. LUCHARS

Vice-President and Treasurer
EDGAR A. BECKER

Secretary and Publishing Manager
HAROLD L. GRAY

***Subscription Rates***

Subscription rates in the United States and Canada, one year, $3; two years, $5; three years, $6; in all other countries, one year, $5; two years, $9. Single copies 30 cents. Entered as second-class matter, April 18, 1925, at the Post Office, New York, N. Y., under the act of March 3, 1879.

***Member***

Audit Bureau of Circulations
National Business Publications
Society Business Magazine Editors


# CONTENTS FOR MARCH, 1952


VOLUME 49 NUMBER 3


## ARTICLES


**Water and Plumbing Systems for a Modern Industrial Plant** ..... 67
J. E. York
**Heating by Atomic Energy** ..... 74
G. M. Harbert
**Drafts Don't Cause Colds** ..... 76
**Apparatus Dew Points at Elevations Above Sea Level** ..... 77
H. Herkimer
**How to Handle Lead Oxide Dust** ..... 78
**Heating and Ventilating Industry Gathers at St. Louis** ..... 79
**Air Conditioning Rodent Quarters** ..... 95
J. M. Ruddy
**Heat Pump Progress Reviewed by Electrical Engineers** ..... 96
**Dallas to Have Air Conditioned Skyscrapers** ..... 102


## REFERENCE MATERIAL


**SECTION—Cathodic Protection Against Corrosion of Heating and Plumbing Equipment**—T. W. Reynolds ..... 83
**DATA SHEET—Pointers on Centrifugal Pump Selection** ..... Opposite 146


## DEPARTMENTS


**Washington News**—Loring F. Overman ..... 4
**Briefly Stated** ..... 64
**What Would You Do?** ..... 101
**News of Equipment and Materials** ..... 103
**New Catalogs** ..... Opposite 110
**Product Applications** ..... 112
**Experience is my Classroom**—T. W. Reynolds ..... 116
**Abstracts and Reviews** ..... 118
**News of the Month** ..... 122
**Getting Personal** ..... 132
**Canadian Degree-Days for December, 1951 and January, 1952** ..... 134
**Coming Events** ..... 136
**Degree-Days for January, 1952** ..... 138



The Contents of HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and by Engineering Index, and are microfilmed by University Microfilms, Ann Arbor, Michigan.



Copyright, 1952, by The Industrial Press



Also Publishers of
HEATING & PLUMBING EQUIPMENT NEWS
and technical books.


## THIS MONTH'S COVER

At Harwell in Southern England, an air to water heat exchanger is being installed in the discharge air duct of Britain's experimental atomic heat pile. The air, having been used as a coolant in the pile, will heat water for a building heating system, as described beginning on page 74.

# Washington News

LORING F. OVERMAN

AT press time for this column, NPA analysts were frantically trying to put out the fire started on February 6 when Washington was visited by members of the Commercial and Industrial Refrigeration and Air Conditioning Industry Advisory Committee.

On that date the IAC members reported:

"A critical situation, compelling at least half of the companies manufacturing commercial and industrial refrigeration and air conditioning equipment to discontinue operations, will develop unless greater quantities of controlled materials are allotted to the industry."

Committee members cited industry surveys showing that severe hardship will result unless future allotments of steel, copper, and aluminum are larger than the industry received during the first quarter of 1952. They pointed out that very serious labor problems are arising because of production cutbacks. The industry has already stopped manufacturing certain models of refrigeration and air conditioning equipment because of insufficient materials, IAC members said. It was also reported that industry members have been trying to get other types of business to keep labor forces intact, but that to date these efforts have not been very successful.

This growing idleness among certain classes of equipment producers—at a time when demands of the defense program do not seem to be developing as fast as had been contemplated—is a subject of growing concern in Washington. It is becoming hard to explain to labor and to management why famine is developing in the midst of plenty; why materials cannot be released at once for needed civilian items when the military does not seem ready to exercise its priorities.

## IAC vs NPA

The Advisory Committee of the Commercial and Industrial Refrigeration and Air Conditioning Industry is not alone in its controversy with NPA. This industry's position is like that of many others, and there is plenty of room to question just how quickly conditions will improve. NPA had been ordered to clear the business runways for the immediate takeoff of a defense program. But at the last minute the program seems to have been radioed back to the hangar while the tower charts a new course, changes motors, re-designs the wings, etc., etc.

Meanwhile, the flight is delayed, and business travelers who can ill afford to wait must stand by.

As for NPA and this industry's IAC, informants within the General Industrial Equipment Division report that an effort is being made to work the problem out within the framework of suggestions made on February 6 by the committee. Taken particularly seriously by NPA is the committee recommendation that the period July 1, 1949 to June 30, 1950 be established by NPA as the base for determining allotments of materials. The full year prior to Korea would serve better as a base period and any six month period, committee members said.

NPA analysts are studying the "metals chew-up" revealed by the industry survey of estimated production for the suggested base period, with the promise that the figures will be taken into consideration in figuring future allotments. At present the industry is assigned materials on a percentage of requests, since consumption figures have not been available for the proposed base period.

## Individual Hardships?

Observers within NPA make a significant comment. They reveal that NPA folks are studying the IAC recommendation seriously, and are much concerned over the threat of shutdowns, unemployment and so on. But they also note that the official position of the Industry Advisory Committee is not "supported by a single individual company appeal for relief from unreasonable hardship."

In explanation of this seemingly enigmatic comment, it must be remembered that Washington is strangely interested this year in what individuals think. The "little fellow's" vote is just as potent as that of the big guy—and much more numerous. Based upon that premise, it must be concluded that if there isn't enough to go 'round, the "wheel that squeaks the loudest will get the grease." In other words, Washington takes under advisement the official viewpoints which industry expresses through such bodies as Industry Advisory Committees and trade associations, but it acts upon evidence of strong pressure from many individuals.

It seems almost unbelievable that such considerations could impose life or death sentences upon an industry or segments thereof. But it must be remembered that many Washingtonians know that their own life or death sentences are to be written in the months between now and November.

So whether or not we like such thinking, or such conclusions, the industries served by HEATING AND VENTILATING will have much to gain by supplementing their Industry Advisory Committee appeal with individual petitions for relief, and with letters or phone calls to members of Congress. The industries which are making their presence felt at the vote level are those which attract the most attention in Washington.

## Small Business Hardships

Some segments of the industry may approach the problem of securing supplementary allotments of materials through the newly established Small Business Hardship Account Panel set up by NPA. Special allotments of controlled materials are available to the panel for distribution to small manufacturers who face a shutdown on account of low allotments under CMP.

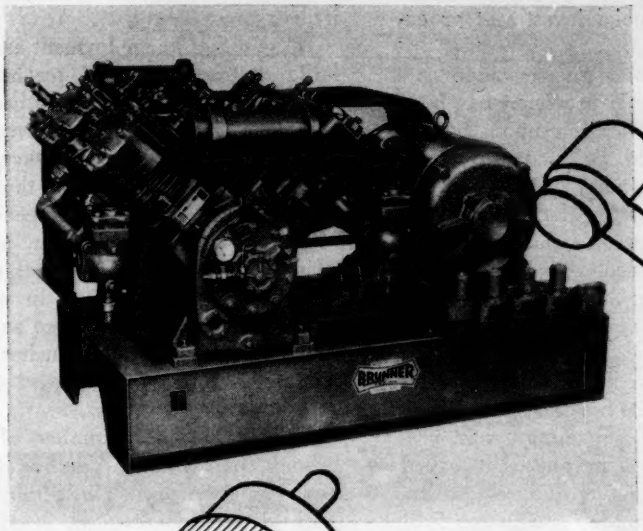
To qualify for a supplemental allotment from the "hardship account", a firm must meet the following criteria:

(1) Must be classified as small business as defined by the recent Department of Commerce study of manufacturing concerns.

(2) It must be a single-line producer, which is defined as manufacturers having more than 50% value of actual production or shipment during the most recent quarter, of products classified as civilian type.

(3) The firm must be faced with failure or prolonged shutdown because it has received insufficient controlled materials.

● The Brunner background of meticulous engineering and precision manufacture is evident in every detail of *all* Brunner refrigeration and air conditioning units. Install Brunner and assure your customers of what they want most—long years of dependable refrigeration or air conditioning with a minimum of maintenance bother.




## Every detail engineered to MINIMIZE MAINTENANCE

## . . . and make contracts easier to close

● If you are in business to sell and install air conditioning and refrigeration, there is food for thought in the rapidly increasing number of Brunner Contractors.

We have the capacity range in equipment and the manufacturing facilities to deliver. Our application engineering staff is ready with the kind of help that wins contracts.

New ideas and improvements are constantly under test in our engineering laboratories to keep Brunner customers in the vanguard on refrigeration and air conditioning developments.

● Our course is shaped for contractor profits. There are many advantages to be enjoyed in selling Brunner equipment. Why not get the entire Brunner story . . . now?

BRUNNER
SINCE 1906

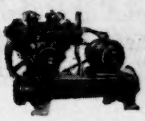
**AIR CONDITIONING**
**AND**
**REFRIGERATION**

**BRUNNER MANUFACTURING CO., UTICA 1, NEW YORK, U. S. A.**

BRUNNER
SINCE 1906

**AIR CONDITIONING**
Self Contained Units to 10 hp.
For remote installations Brunner Condensing Units to 75 hp.

**REFRIGERATION**
Condensing Units from ¼ hp. to 75 hp. 69 Air and Water Cooled Models.



**AIR COMPRESSORS**
Single stage ¼ hp. to 2 hp. Two stage 1½ hp. to 15 hp. Horizontal and Vertical Models.

(4) The plant facilities are not suitable for conversion because either a substantial financial investment or extensive retooling is required.

Although applications for second quarter allotments should have been filed by March 1, provision has been made for their emergency consideration upon arrival. Applications for materials should be made on Form CMP-4B, and should bear the symbol "SBHP" at the top of the form. The form should be filed with any of the delegated Department of Commerce field offices, or with the General Industrial Equipment Division, National Production Authority, Washington 25, D. C.

The applications are to be reviewed by a panel including one representative each from the Office of Civilian Requirements, the Office of Labor, heads of appropriate NPA industry bureaus, and from the Small Defense Plants Administration. To further assist manufacturers in presenting substantiating information beyond that called for in the standard CMP-4B forms, a guide sheet has been made available at Department of Commerce field offices. The guide sheet outlines the type of data that should be attached to the CMP-4B supplemental application, including information regarding the number of employes, as well as operating statements and other pertinent data showing that continued operation under current allotments would result in business failure or prolonged shutdown.

Understandably, business shies at presenting some of the information required, or is unable to provide the detailed data. However, if industry fails to take advantage of machinery "provided" by a beneficent government, then Washington concludes its assistance is not needed. So other wheels, speaking louder, are "greased".

### It Was "Construction Month"

Construction occupied the center of several Washington stages during February. The National Production Authority previewed for the Construction Industry Advisory Committee a proposed draft, and later a revised draft of rules on commercial and industrial building.

Joining with NPA, the Housing and Home Finance Agency uncovered a new regulation covering housing specifically.

And the Construction Industry Advisory Council of the Chamber of Commerce of the United States held a mid-month conference covering all phases of the construction outlook. The Building Research Advisory Board of the National Academy of Sciences held a meeting during the last week of February.

Indicative of how business is beginning to feel about the overlapping of the guns and butter programs, The NPA Construction Industry Advisory Committee recommended that there be no further restrictions on the use of structural steel in commercial building, and that the use of foreign and salvage steel be permitted without specifically asking NPA's approval.

### Labor Speaks

At the Chamber of Commerce confab on building, Labor also took a poke at the mushrooming government controls. Richard J. Gray, president of the Building and Construction Trades Department of the AFL appealed for "a mutual assistance pact" between management and labor to combat government controls in the construction industry.

He said that unemployment among the 3,000,0000 AFL building tradesmen had reached alarming proportions as a result of government cutbacks of building material allotments. He challenged statements of DPA officials that the cutbacks are made necessary by needs of the defense claimant agencies. He urged that labor and management "jointly propose that a screening committee of competent practical men of labor, management and government be set up and given full authority to review and approve, modify or reject, in whole or in part, all requests for materials by these so-called defense claimant agencies, including all branches of the military."

### Standards Discussed

Speaking at the Chamber of Commerce conference, William H. Scheick, executive director of the Building Research Advisory Board, told of long range studies directed toward conservation of building materials.

"Our study is showing," he said, "that more conservation will result from ingenuity of design and construction practice than from revision of standards. Where national standards are kept up to date by the surveillance of established technical bodies they generally permit greater conservation in design than is ordinarily practiced.

"There are three aspects of standards, however, susceptible to improvement in the interest of conservation.

"The first is that the Government has its own standards for federal construction. Some of these not only vary from one agency to another, but all the variations may equal or exceed national standards. An improvement would be effected if the Government would unify and simplify its standards to coincide with those of non-federal constructions. With few exceptions it seems that the same conservation measures should apply equally to federal and civilian building.

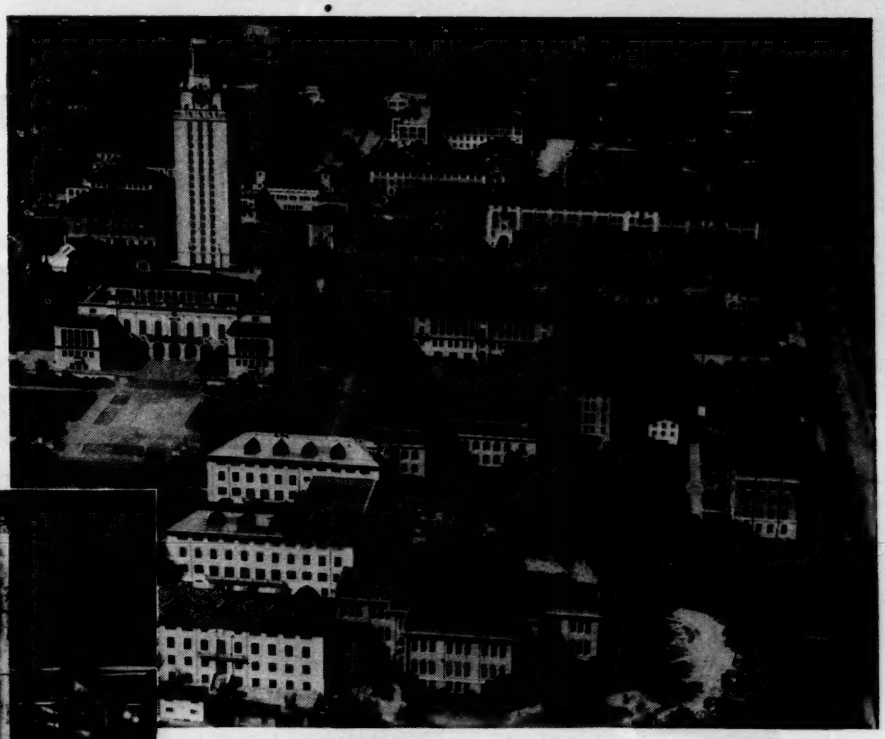
"The second point is the acceptance of standards in building codes. The recognized national codes use essentially the same modern technical standards. This is a time to press for the unification of codes to eliminate the restrictions against conservation in local out-dated codes. The new National Plumbing Code, based on research and industry agreement, is an example of a standard that could be universally adopted.

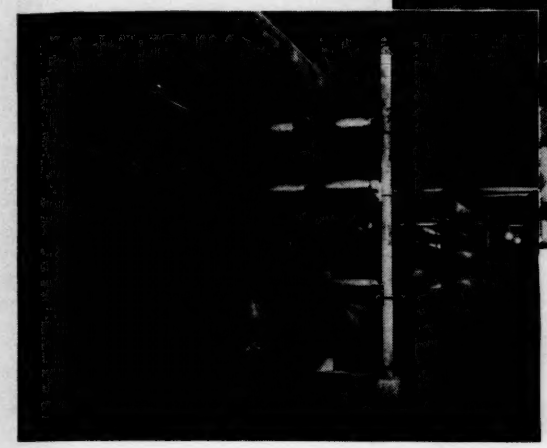
"The third point is the absence of adequate standards in some fields and the need for research to establish them. Space standards for planning are lacking; standards for snow loads are out of agreement; design temperatures for hearing appear unnecessarily conservative for lack of adequate weather data.

"Our study of design practice is producing lists of proposed conservation measures in each technical area. Some are details aimed specifically at conservation of critical materials, such as proposals for the elimination of parapets to conserve copper. Others are broader principles with long-term implications, such as the use of continuity in structural framing design, or the coordination of mechanical layouts with the structure.

"We have asked and are getting fine cooperation from the Government. I hope that the building industry will also see opportunities for its own advancement in the final report of the BRAB conservation study."

*In the air conditioning chilled water distribution system*





## THIS UNIVERSITY COMBATTED THE CORROSION PROBLEM WITH

# Byers Wrought Iron Pipe

When plans were made for the air conditioning chilled water distribution system at a well-known university in the Southwest, the specifiers followed sound, proven practice in safeguarding the installation against premature failure and excessive maintenance by specifying genuine wrought iron. Over 116 tons of Byers Wrought Iron pipe was used in the chilled water header piping of the central water chilling station, chilled and condenser water lines, and steam condensate lines.

A network of chilled water lines, housed in a tunnel, carry the water from the power plant to the buildings. A portion of the tunnel installation is shown above. The two lower lines in the picture carry chilled and condenser water; the smaller, uncovered line above them carries steam condensate. Zumwalt and Vinther, Dallas, were the engineers on the job. R. O. Davis, Inc., Austin, were the contractors.

Byers Wrought Iron pipe has a record of long, dependable service in every one of these "hot spots." Its wide-spread and continued use in these services is the best possible index of its ability to stay on the job longer, at lower cost per year.

You will find some helpful information on the use of wrought iron in our bulletin, WROUGHT IRON IN REFRIGERATION AND AIR-CONDITIONING SYSTEMS.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N.Y.

### Why Genuine Wrought Iron Lasts

This notch-fracture test specimen illustrates the unique fibrous structure of genuine wrought iron—which is responsible for the high corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

# BYERS

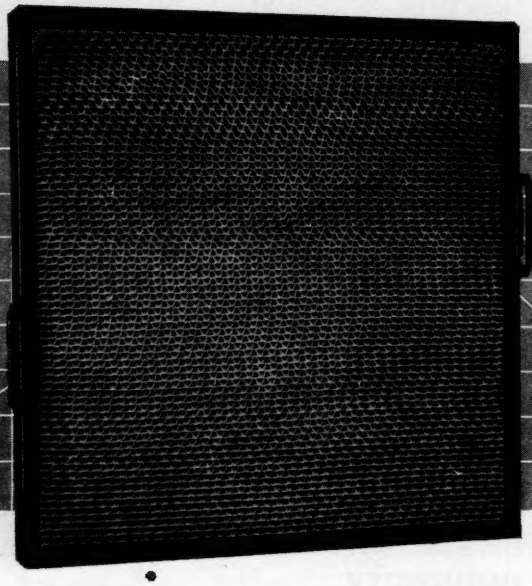
CORROSION COSTS YOU MORE THAN WROUGHT IRON

**WROUGHT IRON**

**TUBULAR AND HOT ROLLED PRODUCTS**

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

# Now you can have



*Performance Rated*

**air filters**

## FAR-AIR* originates greatly improved testing methods that take the guesswork out of air filtration!

All architects, engineers and reputable filter manufacturers know this important fact about air filters: *no filter—regardless of its design—operates at equal efficiency under all dust conditions.* For example, a filter may stop "gravel" with 100% efficiency, but may have 1% efficiency when exposed to dust particles of 0 to 5 micron size. (1 micron—1/25,000 inch.) The new FAR-AIR testing methods accurately rate filter efficiencies under *all* dust conditions — not just one set of laboratory conditions using a "standard" test dust, as in the past.

THIS IS IMPORTANT TO YOU because, for the first time, you can buy air filters whose performance rating under *your* operating conditions is accurately determined in advance. No more guesswork when you buy FAR-AIR filters! You may also save needless expense by installing the type filters that are no more efficient than necessary to meet the requirements of the job.

This tremendous advancement in the science of air filtration is ready to serve you now. Your nearby Farr Field Engineer can be of valuable assistance in solving your air filtration problems. Why not call him today?

Write today for your copy of the free booklet on the new Farr testing procedures, which gives full technical information on the equipment used in these tests and the results obtained. Address: Farr Company, P.O. Box 10187, Airport Station, Los Angeles 45, California.

**FAR-AIR FILTERS**

*"Better by Farr"*

*Trade Mark Reg.

**FARR COMPANY** *Manufacturing Engineers*

Los Angeles • Chicago • New York

M'f'd under license by Control Equipment Co., Ltd., Montreal, Canada

# *new in '32*

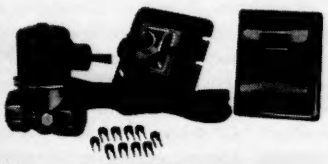
# *still better today*

**Improved K3-A Solenoid Gas Valve...**

**Quiet—Dependable—Hi-Capacity—**

**Soft Seat—For All Gases—**

Way back in 1932, the forebear of the present K3-A was originated, developed and pioneered by General Controls. It became the first in a long series of quiet, dependable, two-wire solenoid magnetic gas valves that today are standard equipment at home and in industry for controlling gas to warm air furnaces, gas-fired boilers, conversion burners and similar applications. Closing with the gas flow, in the K3-A the pressure is on the top of the soft seat assuring indefinitely tight valve shut-off. Closing is automatic in case of power failure, and the K3-A, like all other General Controls solenoids, is absolutely humless when energized. Current consumption is low and the extremely compact valve easily meets high flow capacities and operating pressure requirements. In the K3-A you find just one more sound reason why the leaders everywhere declare that for the best in *automatic* controls, it's General Controls!



**T-30 PACKAGE SET**

For automatic heat at home, the General Controls T-30 Package Set is a sure short cut to economical and trouble-free comfort. Included with the graceful T-70 Timer Thermostat, is the long-proved, Type K3 Magnetic Gas Valve, Transformer and Thermostat Cable. Optional Timer Thermostat is furnished in two models, either for internal night setting (T-70-T) or with both day and night temperature selection at your finger tip (T-70-X) on the face of the sleek and satin-finished cover.

**GENERAL CONTROLS**

801 ALLEN AVENUE GLENDALE 1, CALIFORNIA

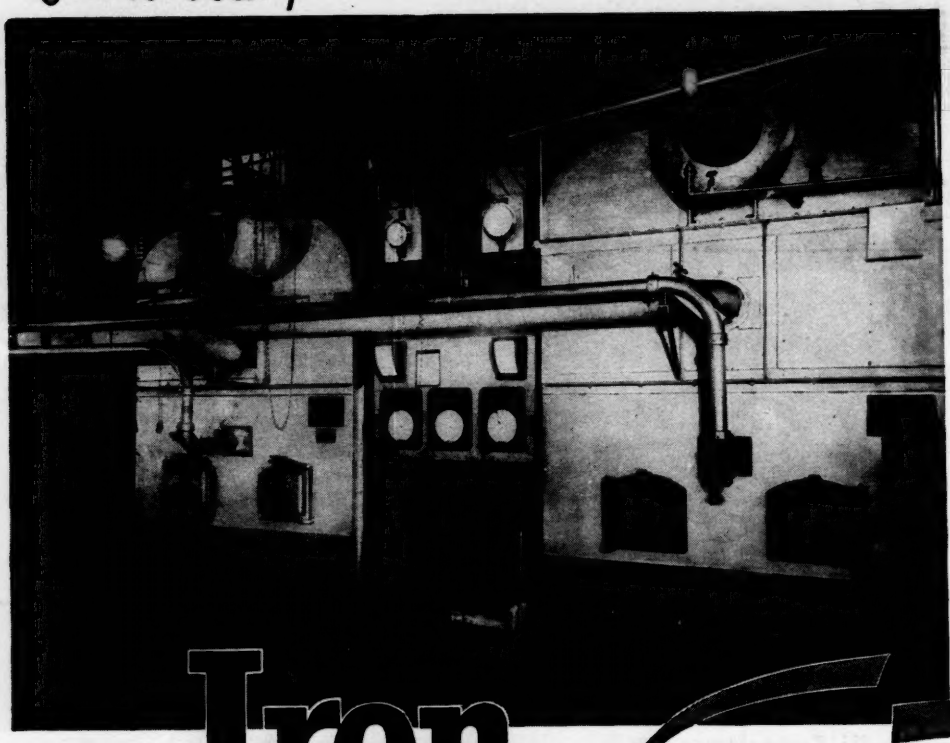
*Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls*

FACTORY BRANCHES: Baltimore 5, Birmingham 3, Boston 16, Buffalo 3, Chicago 5, Cleveland 15, Columbus 15, Dallas 2, Denver 4, Detroit 21, El Paso, Glendale 1, Houston 6, Indianapolis 4, Kansas City 2, Milwaukee 3, Minneapolis 2, Newark 6, New Orleans, New York 17, Omaha 2, Philadelphia 23, Pittsburgh 22, St. Louis 3, San Francisco 7, Seattle 1, Tulsa 6, Washington 6, D.C.
DISTRIBUTORS IN PRINCIPAL CITIES

# "Our Iron Fireman stokers burn lowest grade coal yet deliver top efficiency"

***Says Mr. Wm. F. DeWolfe, Chief Engineer, St. Joseph's Hospital, Saint John, N. B.***

"Our steam demand varies from 50% to 150% of boiler rating and we are very well pleased with the flexibility and over-all performance of our Iron Fireman stokers. We are burning Minto coal, the lowest grade coal in this area, yet the monthly average efficiency has been as high as 81% at an average monthly rating of 82% of capacity. At summer loads with boiler rating down to 30% and lower we can still get 65% efficiency."



Iron Fireman Pneumatic Spreader stokers in the St. Joseph's Hospital boiler room. Coal is dried, pre-heated pneumatically conveyed and distributed over the entire fuel bed.

# Iron Fireman

## PNEUMATIC SPREADER STOKERS

The Iron Fireman Pneumatic Spreader stoker is a coal-drying, coal conveying, and highly efficient combustion system, all in one money-saving package. It burns a wide range of coals, including low-ash fusion, sub-bituminous and lignite—ranging from ¼" slack to 2" top size. The fuel is dried and conveyed by hot furnace gases directly from main bunker to fire. Readily adaptable to any boiler room layout. Capacities available to 1,000 boiler horsepower in single units; multiple units for larger capacities. Find out how much an Iron Fireman can save for YOU. Phone your nearest dealer or send coupon for descriptive literature.

***MAIL COUPON FOR LITERATURE***

IRON FIREMAN MANUFACTURING CO.
3277 West 106th Street, Cleveland 11, Ohio.

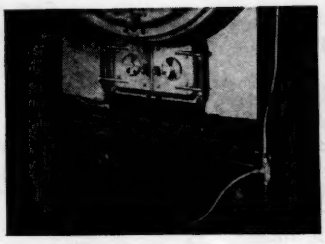
Please send literature as checked:

☐ Pneumatic Spreader Stoker ☐ Coal-Flow Stoker
☐ Commercial Gas Burner ☐ Rotary Oil Burner

Name_____

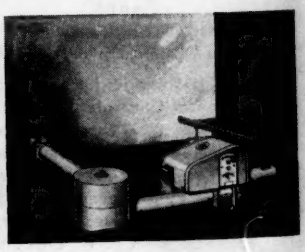
Address_____

City_____ State_____



**Iron Fireman Rotary Oil Burner**

Fires low-cost, heat-rich heavy oils (5 & 6) with complete uniformity regardless of viscosity. A real money-saver. Capacities to 500 boiler horsepower.



**Iron Fireman Coal-Flow Stoker**

Feeds coal direct from bin. No coal handling. Coal and air automatically adjusted to boiler load at all times. Capacities to 500 boiler horsepower.

**AUTOMATIC FIRING FOR HOMES, BUILDINGS, INDUSTRIAL PLANTS**

# Just Off the Press!

## HERE'S VALUABLE, UP-TO-THE-MINUTE INFORMATION

*To Help You Solve Your*

## AIR CONDITIONING PROBLEMS!

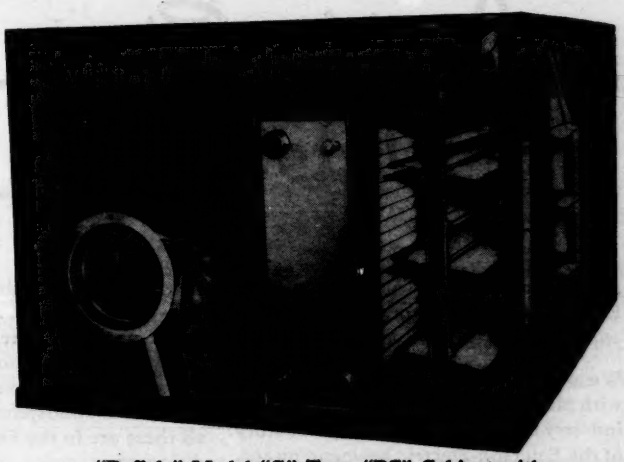
*Write*

## FOR YOUR COPY TODAY

• Here is information on the very latest developments by "Buffalo"—the new model "G" Air Conditioning Cabinets. Bulletin 3703A explains fully, by detail photos, diagrams, charts and tables, what these units can do for you.

• You'll be interested in the developments in these new "Buffalo" units. External appearance is clean and modern. The light, efficient "mixed-flow" fans are stable in performance over a wide range of capacities and pressures. Sectionalized construction and standardized parts make for easy installation, simple maintenance and flexibility of combinations. The new model "G" Vertical Type "VPC" Cabinet is in three easy-to-assemble parts—blower head, coil section and pan—easy to move thru ordinary building openings—and uses flat type Hi-velocity filters, which greatly reduces the space requirements of the unit. Both Vertical and Horizontal cabinets may be equipped with Air Washer sections, and any air conditioning function or combination of functions can be had.

• For helpful information on your air conditioning problems, write today for Bulletin 3703A, on your company letterhead.



"Buffalo" Model "G" Type "PC" Cabinet with side panels removed. Simple cooling, cooling and dehumidifying, heating and humidifying, continuous cleaning—are available functions in these cabinets.

"Buffalo" FIRST FOR FANS

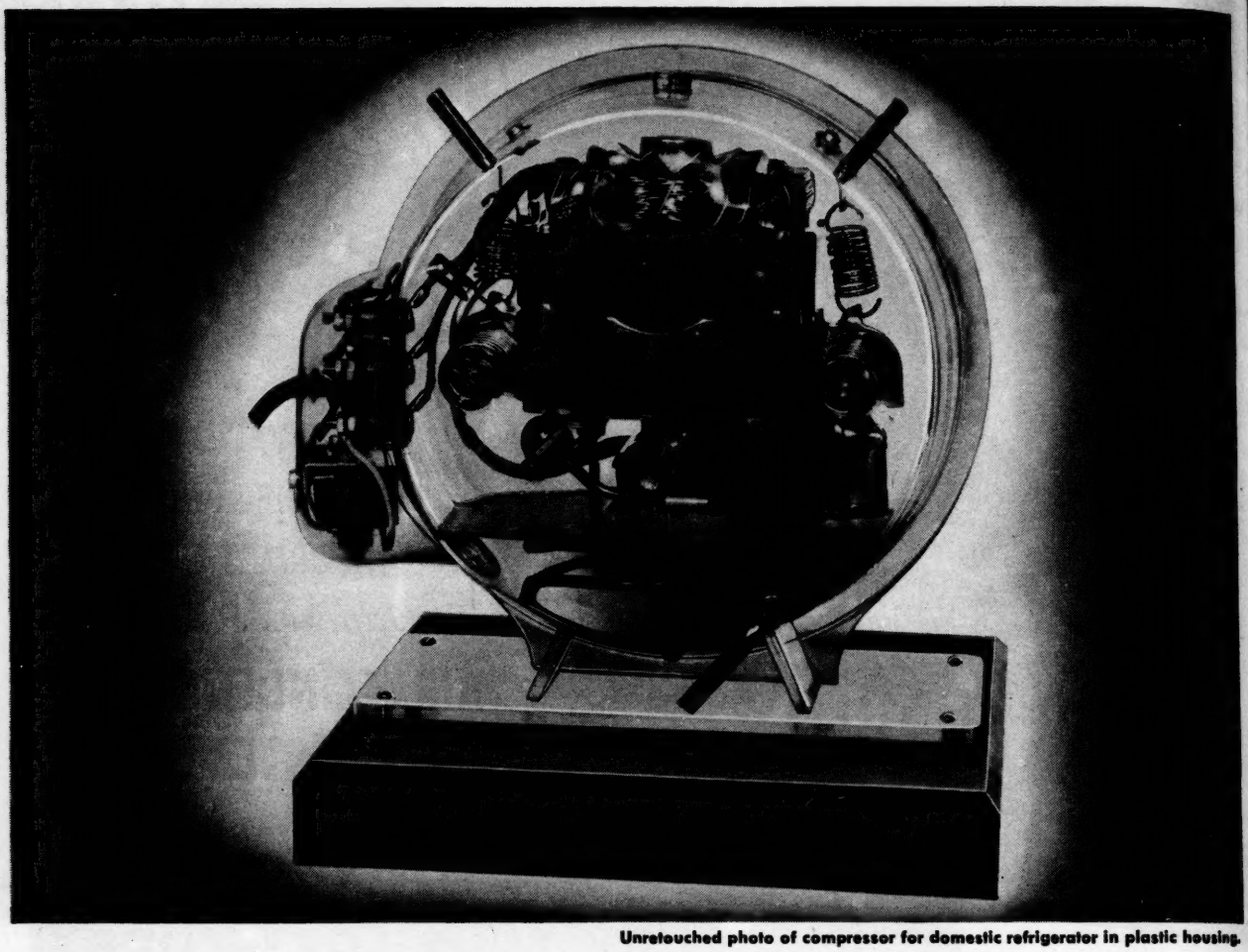
# BUFFALO FORGE COMPANY

480 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

*Sales Representatives in all Principal Cities*

NTILATING AIR WASHING COOLING AIR TEMPERING HEATING INDUCED DRAFT EXHAUSTING PRESSURE BLOWING



Unretouched photo of compressor for domestic refrigerator in plastic housing.

# Inside Story OF THE Outstanding Hermetic Motor

Did you see this *Compressor, with Emerson-Electric Motor, at the Refrigeration and Air Conditioning Exposition?

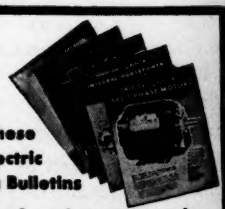
We don't make hermetic Compressors with plastic housings, but we thought the industry might like to get the inside story of the Emerson-Electric hermetic motor. We provided this special unit so that you could actually see *inside*... see the end result of precise manufacturing techniques.

The selection of steel for laminations... use of special insulating materials... unusual handling of machined parts... stator winding in temperature and humidity controlled rooms... final testing and sealing for shipment under accurately controlled atmospheric conditions... all these are in the Emerson-Electric tradition of precision manufacture.

This is the inside story of America's outstanding hermetic motor. As part of *your* compressor units, Emerson-Electric motors will deliver outstanding performance.

**THE EMERSON ELECTRIC MFG. CO. • St. Louis 21, Mo.**

*Manufactured by Tecumseh Products Co., Tecumseh, Mich.

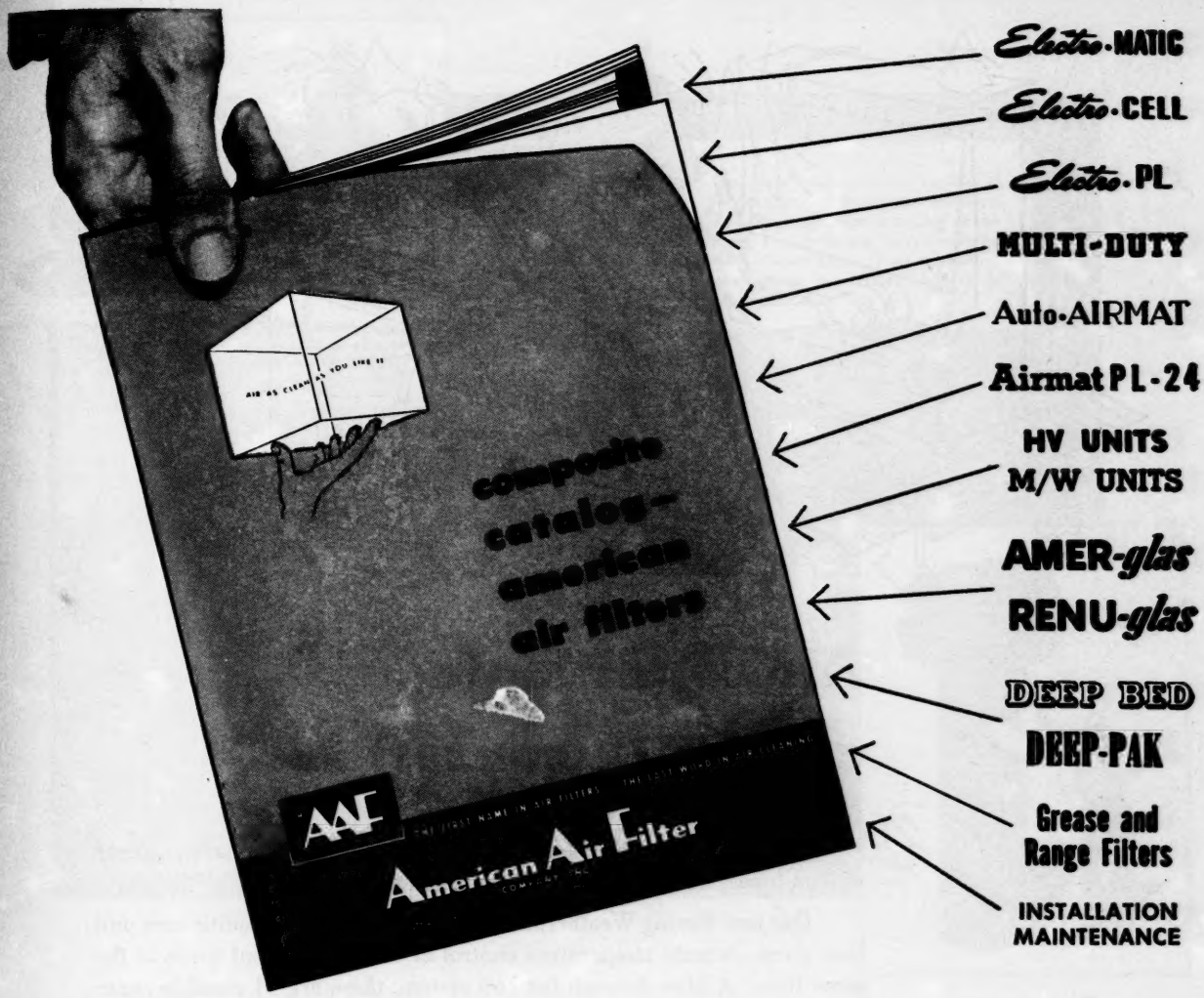


**Write for these Emerson-Electric Motor Data Bulletins**

Appliance and equipment manufacturers, with applications for motors of 1/20 to 5 h.p., can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ M78-A Capacitor-Start
- ☐ M78-B Split-Phase
- ☐ M78-C Integral
- ☐ M78-D Fan-Duty
- ☐ M78-E Oil-Burner
- ☐ M78-F Jet Pump
- ☐ M78-G Blower

**EMERSON ELECTRIC**
MOTORS • FANS APPLIANCES




# NEW! ready reference

**...for Engineers and Executives responsible for air filtration.**

It's just off the press and free for the asking. The new COMPOSITE CATALOGUE—AMERICAN AIR FILTERS is a valuable reference work that was three years in preparation. Its thirty-two pages cover essential information on fifteen basic filter types with engineering data, dimension and capacity charts, tables, and installation-maintenance section. Also includes condensed sections on "Air Filter Efficiency" and "Size and Characteristics of Air-Borne Solids". Liberally illustrated and specially indexed for ready reference this Composite Catalogue is designed to save your time.

*Send this coupon to us today!* →

American Air Filter Company, Inc.
215 Central Avenue
Louisville 8, Kentucky

Please send me your new Composite Catalogue—American Air Filters: Bulletin No. 510.

NAME_____

TITLE_____

COMPANY_____

CITY_____ STATE_____

**American Air Filter**
COMPANY, INC.

215 Central Avenue, Louisville 8, Ky.
American Air Filter of Canada, Ltd., Montreal, P. Q.
Pacific Division Office, San Francisco, California

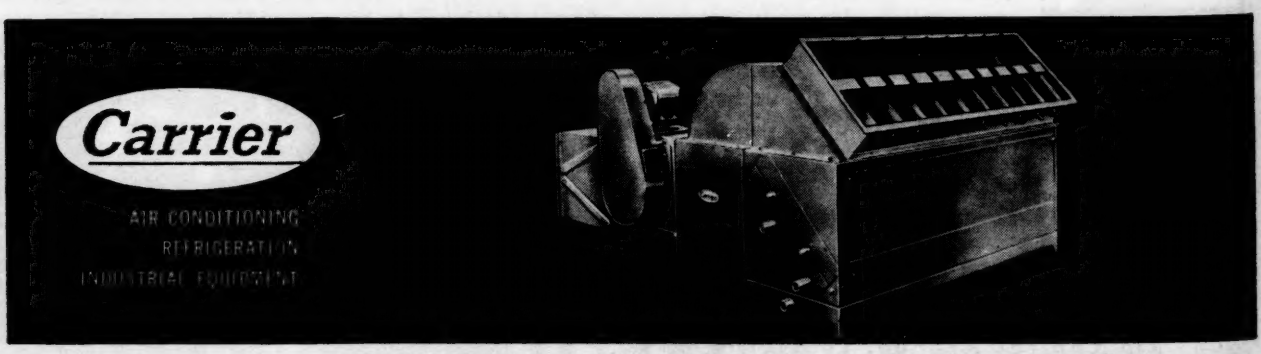
# Air conditioning can be in concert too

If you've had problems air conditioning buildings that have a variety of heat loads, here's news that'll be music to your ears.

Our new Zoning Weathermaker is a year-round air conditioning unit that gives accurate temperature control of several different zones at the same time. A blow-through fan coil system, there are 14 possible zones available, each zone having a hot and cold damper placed at 90 degrees to each other, so one is closed when the other is open. And any degree of modulation is possible.

Sectionalized for easy installation, the Zoning Weathermaker can be suspended from the ceiling or floor mounted. And for greater flexibility of application, all piping connections can be made from either side.

This new Weathermaker joins Carrier's great family of products . . . products matched in size and performance to work together . . . products to meet every industrial or comfort air conditioning requirement you have. Carrier Corporation, Syracuse 1, N. Y.




The Carrier Zoning Weathermaker, available in 5 sizes with cooling coils in 4 or 6 row direct expansion . . . or 4, 6 and 8 row cooling coils for brine or chilled water. Cooling capacities from 15 to 80 tons, 4100 to 16,400 cfm.

The large photo shows section of intake pipe and horizontal scrubbers on a large gas pipe line. One of the big tees (submerged in this installation) is inset below. Inset opposite is one of the big WeldELLS used in this work.

## GUESS-WORK WON'T GO ON THE PIPE LINES

As the demand for oil and gas mounted, the pipe lines grew. The first growth was in number and miles; then in size and pressure. The use of larger pipe lines under higher pressure has hurled a challenge at the pipe designer. To hold down costs he must press further toward the yield point of pipe line materials . . . but never too near the danger point. Sound engineering is indeed required to insure safe operation under loadings that stress materials at 65% to 85% of their yield strength. There is no "margin for ignorance" here. You must *know!*

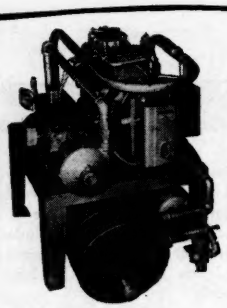
Recent Taylor Forge contributions to the pipe lines include improved designs of WeldELLS in large sizes and tees giving greater safety at branch connections... produced in materials whose strength matches or exceeds that of the tough API5LX pipe now being used in transmission lines.

Ask for the facts about the WeldELL line of welding fittings and Taylor Forged Steel Flanges.

# TAYLOR FORGE

## TF WeldELLS®

**TAYLOR FORGE & PIPE WORKS** General Offices and Works: P. O. Box 485, Chicago 90, Ill. Offices in all principal cities. Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada.



**FLOW-COLD* LIQUID CHILLERS**

Self-contained, compact and efficient Units, furnished completely wired and with refrigerant piping completed at the Factory. For Industrial applications or for Residential uses, ACME FLOW-COLD Units are simple and easy to install and will give lowest cost, most efficient cooling. Can be used for Heat Pump application where a suitable heat source is available.

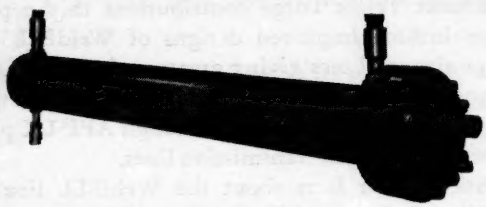
In selecting the most efficient equipment to perform a specific job of refrigeration, your task is greatly simplified when you specify "ACME" — for the ACME line is complete enough to give you a suitable ACME Product, for every kind of Residential or Industrial chilling or liquid cooling requirement. And you are certain of getting the most practical, maintenance-free, low cost operation, for ACME equipment has been preferred in the heavy Refrigeration Industry for more than 30 years.

**ACME DRY-EX* CHILLERS**

For brine, alcohol, water or any low viscosity. fluids. There are more than 700 combinations of refrigerant heads, baffle spacings and tube lengths. The most efficient direct expansion, shell and tube units offered to the Refrigeration Industry in the last 10 years.

# tailored to fit every kind of LIQUID CHILLING or WATER COOLING JOB

ACME ALSO MANUFACTURES: EVAPORATIVE CONDENSERS • FREON CONDENSERS • AMMONIA CONDENSERS • SHELL AND COIL CONDENSERS • SHELL AND TUBE CONDENSERS • FIN COILS • PIPE COILS • COOLING TOWERS • OIL SEPARATORS • LIQUID RECEIVERS • HEAT EXCHANGERS



**UXR DRY-EX* WATER CHILLERS**

For smaller loads, ACME has available the UX and the UXR type DRY-EX models, with both fixed and removable tube bundles. For applications involving brine, glycols, liquid sub-cooling or inter-stage condensing, consult factory for additional information and recommendations.

**HI-PEAK* WATER CHILLERS**

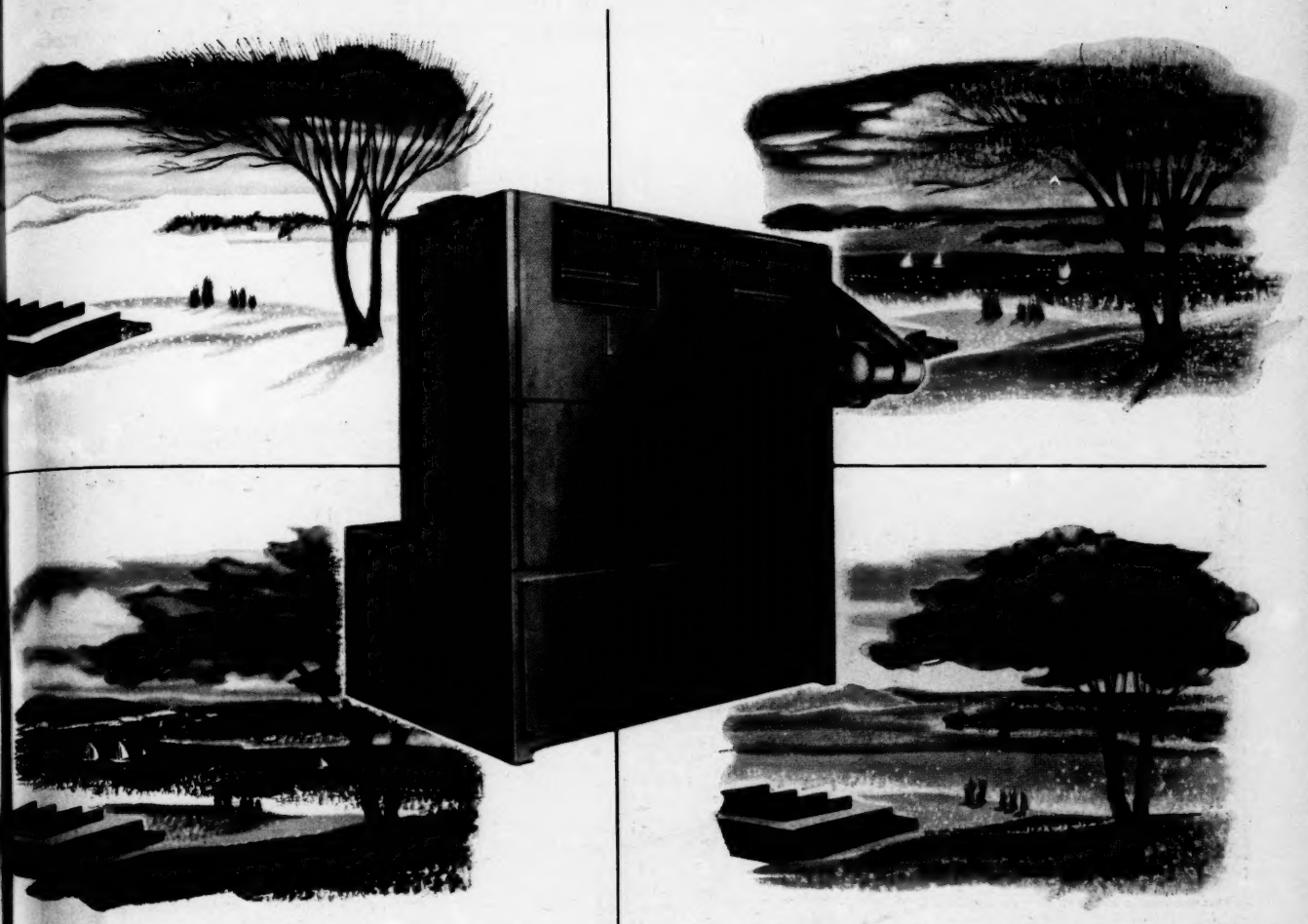
Are offered in seven standard sizes, for intermittent or continuous operation. HI-PEAK Water Coolers have large storage capacity and are galvanized after fabrication. Factory Insulation optional. Equally efficient for use with Freon or Ammonia, require a separate Compressor, as it is not a self-contained cooling unit.

ACME PRODUCTS

Acme INDUSTRIES, INC. JACKSON, MICH. U.S.A.

CONTINUOUSLY SERVING THE REFRIGERATION INDUSTRY SINCE 1919

**American Blower – a time-honored name in air handling**



American Blower Air Conditioning units are designed for summer cooling and dehumidifying and winter heating and humidifying.

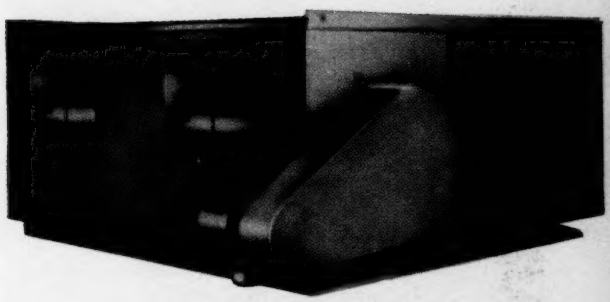
This dual function by the same piece of equipment results in substantial savings in cost and offers much in comfort.

Three types are available: the Type A Conditioner for normal unitary type applications, the Type S Conditioner for unitary type application where washed air or high relative humidities are required, the Type M Conditioner for central system installation.

For data, consult the nearest American Blower Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION



American Blower Type A Conditioner. Capacities from 1000 to 13,600 cfm. Either direct expanded refrigerants, chilled water, well water or brine can be used for cooling and steam or hot water for heating.

# AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

*Serving home and industry*

# He used his **head** instead of his back!

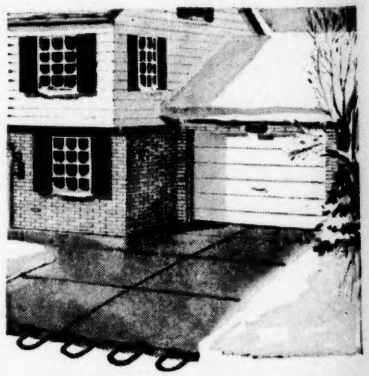
## Steel pipe snow melting systems enhance property values, too!

The most envied man in any block, a few years ago, might have been the one with a new post-war car in his garage . . . or a television antennae on his chimney. But during the last "big snow", thousands of weary shovel wielders would have voted the foresighted owner of a snow melting system just about the luckiest "man of the year."

The complete passing of the snow shovel may still be years away but, more and more, home owners are installing hot water snow melting systems to keep sidewalks, driveways, steps and service areas free of snow and ice all winter long. For these systems steel pipe is naturally first choice!

The durability, adaptability and relative economy of steel pipe helps to put this "automatic snow remover" within the reach of thousands of home owners—less than the cost of an aching back and stiff muscles, or the continued inconvenience of a snow-bound car.

Yes, snow melting is definitely "coming into its own", and remember, the property *with* it always will be a preferred value.



*With a driveway snow melting system the family car is always instantly available for pleasure, business, or emergency use. Steel pipe snow melting keeps Americans mobile!*

Steel Pipe is First Choice

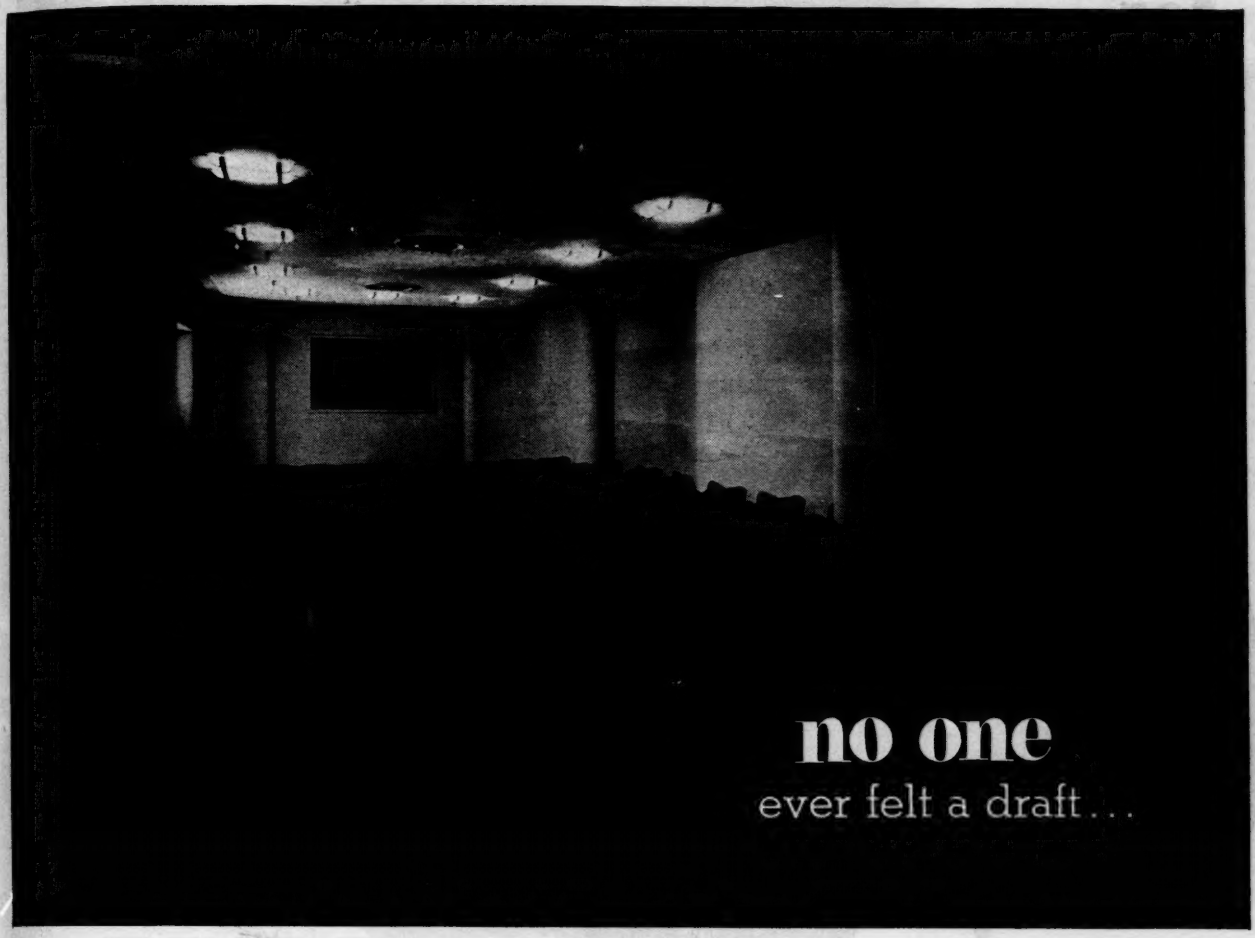
**Write for a copy. A free 48-page color booklet "Radiant Panel Heating with Steel Pipe"**

**COMMITTEE ON STEEL PIPE RESEARCH**

**AMERICAN IRON AND STEEL INSTITUTE**

**350 Fifth Avenue, New York 1, N.Y.**

THE UPJOHN COMPANY's new manufacturing building in Kalamazoo, Michigan. Auditorium, cafeteria, employee lounge and offices are air conditioned and use Kno-Draft *Adjustable* Air Diffusers throughout. *The Austin Company, Engineers and Builders.*




# *from a* kno·draft adjustable air diffuser

No. 1 reason why so many Kno-Draft *Adjustable* Air Diffusers are being specified and installed these days is because they do their job right. Soundly engineered and uncomplicated in operation, they distribute air evenly and *without drafts.*

No. 2 reason is beauty. Dynamically simple in design, Kno-Draft *Adjustable* Air Diffusers are "at home" in any surroundings—whether left in their natural spun aluminum finish or painted to match the ceiling.

No. 3 reason is adjustability *after* installation. This saves an enormous amount of slide rule figuring. A simple screw-driver adjustment balances temperature and air distribution throughout the conditioned area.

No. 4 reason is customer satisfaction. Users *like* the results they get with Kno-Draft *Adjustable* Air Diffusers. There are types and sizes to meet every need.

NEW EDITION! KNO-DRAFT DATA BOOK now in new 32-page format. Complete up-to-the-minute specifications, engineering and installation data on Kno-Draft *Adjustable* Air Diffusers. Bring your files up to date. Mail coupon today.

TRADE MARK 'KNO-DRAFT' REG. U. S. PAT. OFF.

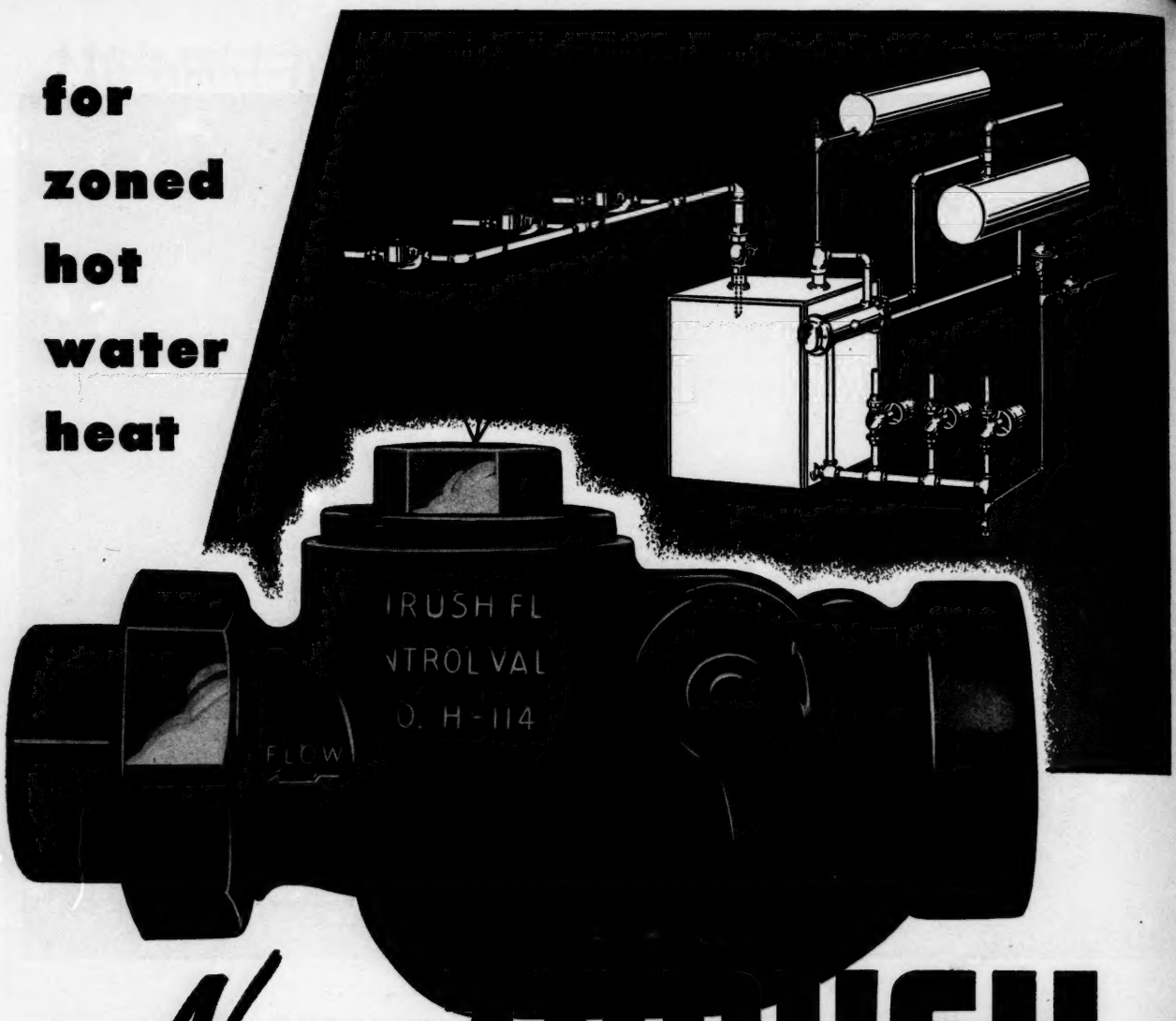
**W.B. CONNOR ENGINEERING CORP.**
Danbury, Connecticut
AIR **diffusion · purification · recovery**
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

**W. B. CONNOR ENGINEERING CORP.**
**Dept. J-32, Danbury, Connecticut**

Please send me the *new edition* of the Kno-Draft Data Book—without obligation, of course.

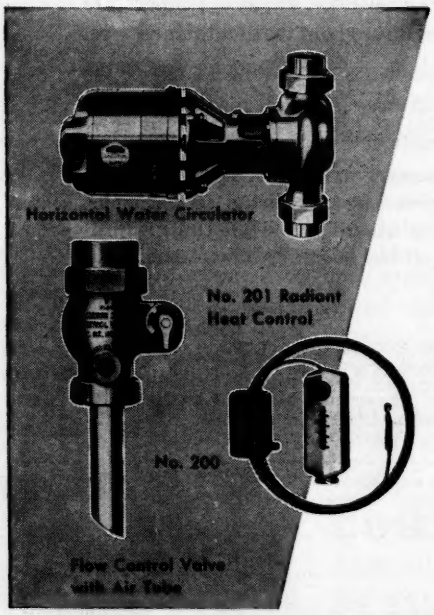
Name.....
Position.....
Company.....
Street.....
City..... Zone..... State.....

# for zoned hot water heat




# the New THRUSH

## HORIZONTAL FLOW CONTROL VALVE

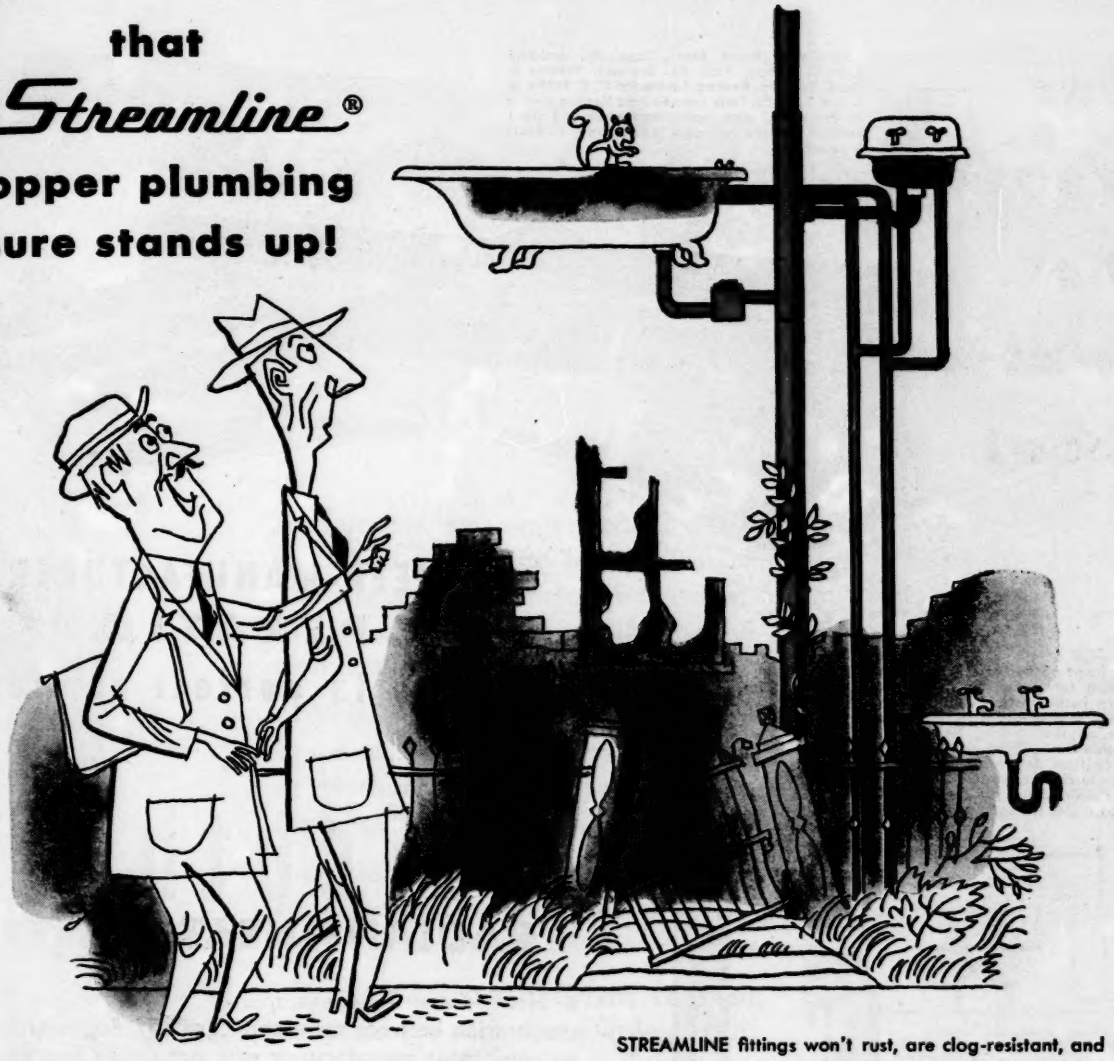



**HERE'S THE valve you need for zoning hot water heat. Just the thing for low basements. It saves pipe, simplifies installation and gives more head room . . . especially important on long runs. As the illustration shows, this valve feeds straight out from the main and saves several inches of head room over angle type valves. There's a Thrush Flow Control Valve for every need . . . the line is complete with angle and vertical valves, with or without air tube, and the new horizontal space-saving valve announced here. All have the same time-tested operating principle and working parts. For easy zoning of hot water heat and assured customer satisfaction, install the complete forced circulating Thrush Flow Control System. See your wholesaler today or write Department D-3**

## H. A. THRUSH AND COMPANY

**PERU, INDIANA**

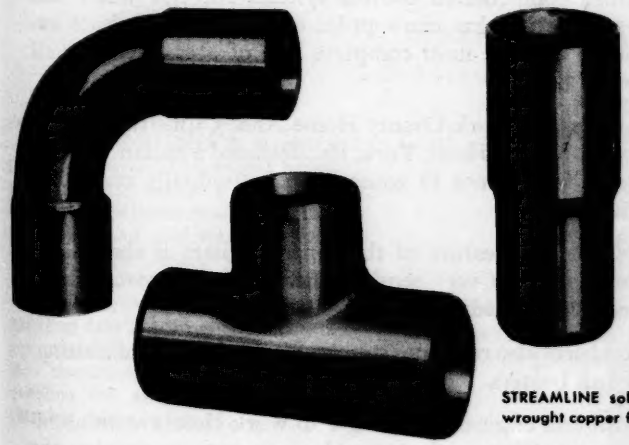
# that *Streamline*® copper plumbing sure stands up!



STREAMLINE fittings won't rust, are clog-resistant, and they can't be loosened by vibration. So when you install STREAMLINE solder type fittings, you can be sure you're installing a permanently reliable plumbing system that will last for years and years—even under the toughest conditions.

STREAMLINE wrought fittings are easy to install because they are light in weight . . . dimensions are accurate . . . and because solder joints are the same uniform depth to make it easy to compute the tubing length. By reducing handling time, STREAMLINE fittings increase the number of jobs you, as a contractor, can handle.

STREAMLINE fittings provide an attractive, snug-fitting system that tests leakproof on the first try and won't develop leaks later. Next time you install a plumbing, air conditioning or industrial system, be sure it's a STREAMLINE system.



STREAMLINE solder type wrought copper fittings.

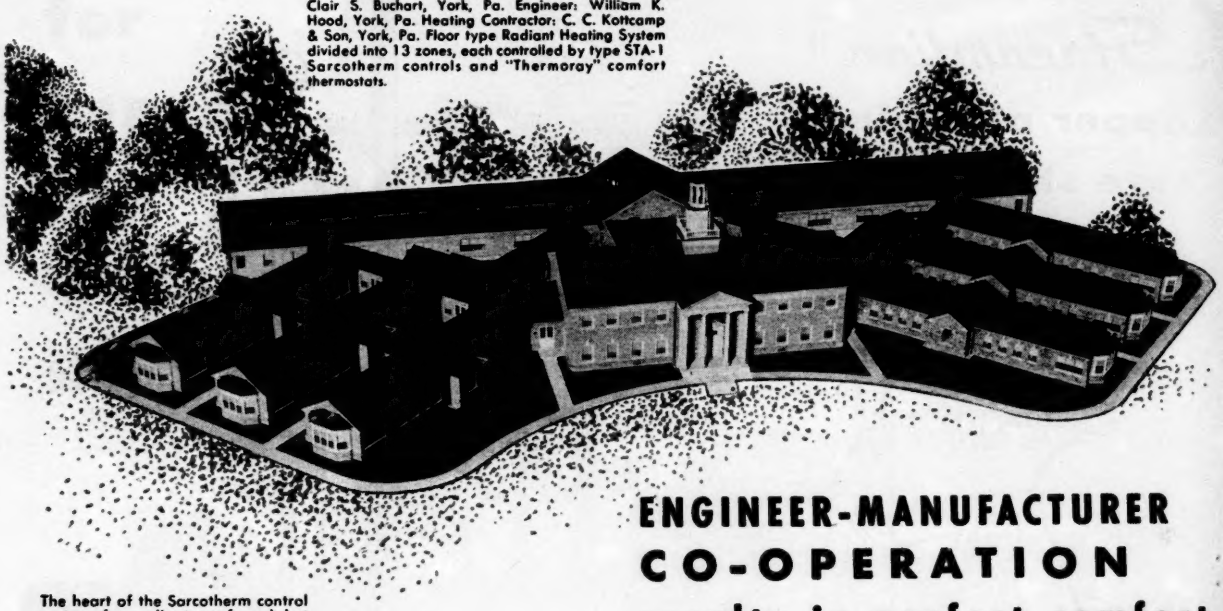
STREAMLINE threaded cast bronze fittings.

See your jobber for further information or write for catalog S-352 describing our complete line of STREAMLINE wrought copper and cast bronze fittings.

76

MUELLER BRASS CO STREAMLINE PRODUCTS

**MUELLER BRASS CO.** PORT HURON 2, MICHIGAN



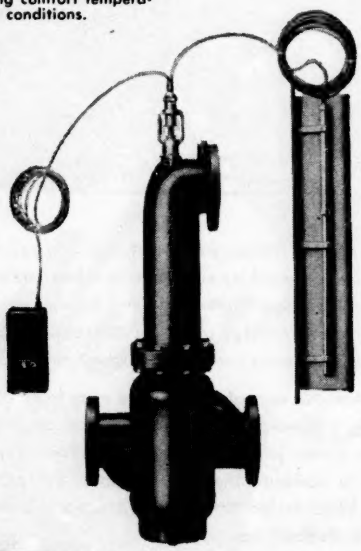
York County Home Annex, York, Pa. Architect: Clair S. Buchart, York, Pa. Engineer: William K. Hood, York, Pa. Heating Contractor: C. C. Kottcamp & Son, York, Pa. Floor type Radiant Heating System divided into 13 zones, each controlled by type STA-1 Sarcotherm controls and "Thermoray" comfort thermostats.

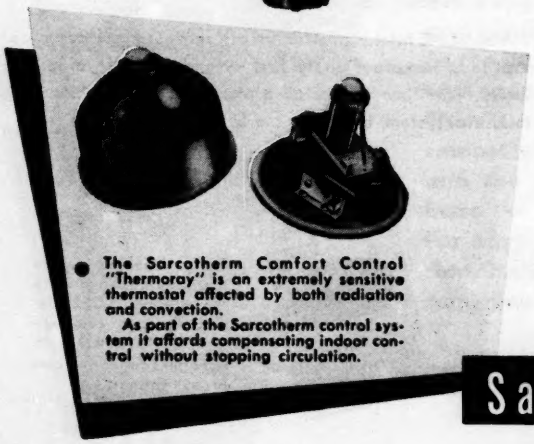
# ENGINEER-MANUFACTURER CO-OPERATION results in perfect comfort

WITH

# Sarcotherm
## RADIANT HEAT CONTROL

The heart of the Sarcotherm control system for radiant or forced hot water heating is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they anticipate changes in heat loss ratio, thus maintaining comfort temperatures under all conditions.





● The Sarcotherm Comfort Control "Thermoray" is an extremely sensitive thermostat affected by both radiation and convection.

As part of the Sarcotherm control system it affords compensating indoor control without stopping circulation.

● Here is a striking example of the advantages of close cooperation between the architect's designing engineer and an equipment manufacturer who not only offers complete weather compensated control systems for hot water and radiant heating, but can supplement this with 30 years' experience and the most complete line of accessories for all types of heating.

In the case of York County Home Annex illustrated, engineer William K. Hood, York, Pa., designed a radiant heating system divided into 13 zones, each individually controlled by Sarcotherm.

An important feature of the control system is the unique "Thermoray," a very sensitive heat loss thermostat, influenced by both radiation and convection.

Sarcotherm also regulates supplementary baseboard heating, and unit heaters.

Sarcotherm engineers are eager to work closely with architects, consulting engineers and contractors to develop the best control hook-up and assure its correct installation.

Send us your next problem—there is no obligation. Or write for complete catalogue.

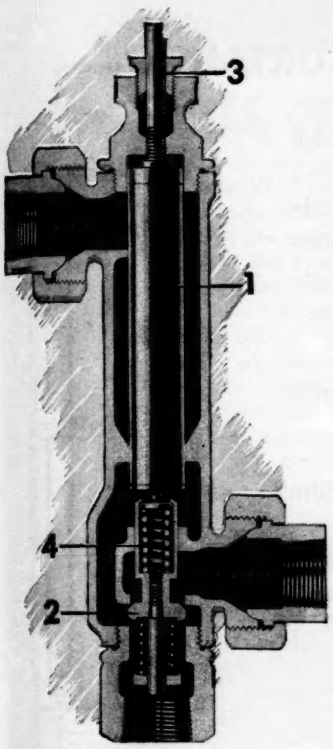
22

**Sarcotherm CONTROLS, INC.**
**EMPIRE STATE BUILDING · NEW YORK 1, N. Y.**

A SARCO PRODUCT

# For Her Sake

## Temper it with
## SARCO DB WATER BLENDERS



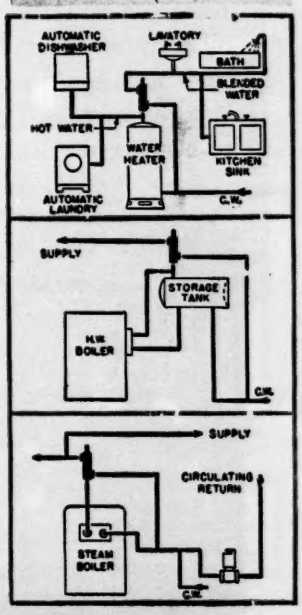

Modern heating requires boiler water at 160 to 180°F and higher. Where submerged coils or "below-water-line" heaters are used, this can also be the temperature of domestic hot water.

While such high temperatures may be desirable for automatic dish washers or washing machines, they are too high for bath room fixtures.

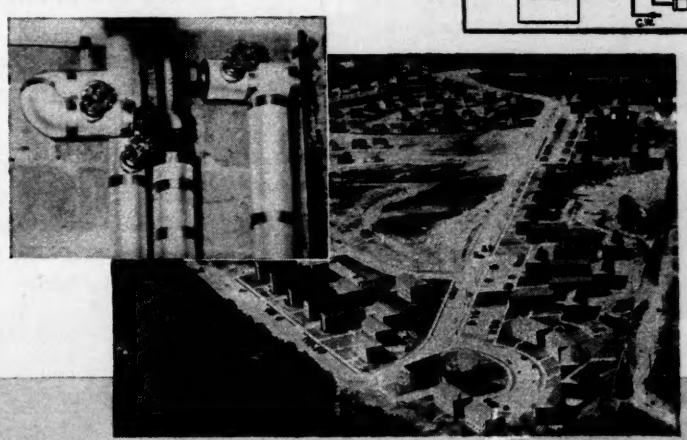
By installing a Sarco Blender, both temperatures are automatically controlled at the desired level.

It provides two different constant temperatures also from independent water heaters.

Full information in Bulletin 803.




SARCO DB BLENDER, a quality tempering valve. A powerful liquid expansion thermostat 1 with standard Sarco bellows modulates flow of *both* hot and cold water by positioning single seated valve 2, of bronze. Positive shut-off when no water is drawn. Standard range 120°F to 160°F adjustable at 3 with key provided. A relief spring 4 protects thermostat. Note union connections for easy inspection and cleaning. Sizes ½" to 3".



342

Forty-five 1¼" Sarco DB blenders on hot water converters at Gregory Estates, Seat Pleasant, Md., a 500 garden apartment community.

**SARCO COMPANY, INC.**

EMPIRE STATE BUILDING, NEW YORK 1, N. Y.
SARCO CANADA LTD., TORONTO 5, ONTARIO

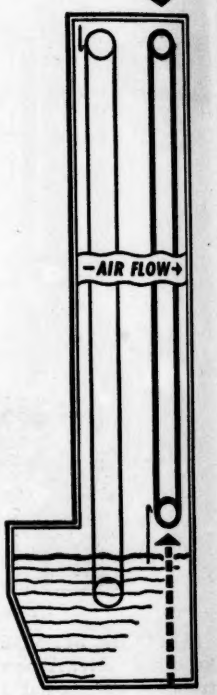
REPRESENTED IN PRINCIPAL CITIES

# GET DOUBLE PROTECTION!

## ONLY STAYNEW

## AUTOMATIC AIR FILTERS HAVE THIS DRY CURTAIN.....

Staynew Model A-3 Automatic is the only air filter designed to give the *double protection* of double filter curtains—the first wet, the second dry. There's never oil entrainment and the cleaned side of curtains is always on the filtered air side. Staynew Model A-3 Filters are designed for both light dust load installations and for heavy duty industrial service where large volumes of air are to be filtered.



Automatic Self Cleaning Type Filter

- Highest efficiency of any mechanical type automatic filter.
- Exceptionally large dust holding capacity.
- Absolutely no oil entrainment in air stream.
- Motor and control unit mounted on clean side of filter.
- Combination gear and roller chain drive (no belts to slip).

Bring your filtration problems to Staynew. If the filtration of large volumes of dirty air at high efficiency and low cost is required, let the Dollinger engineers show you how and why Staynews are your answer. Write for descriptive folder.

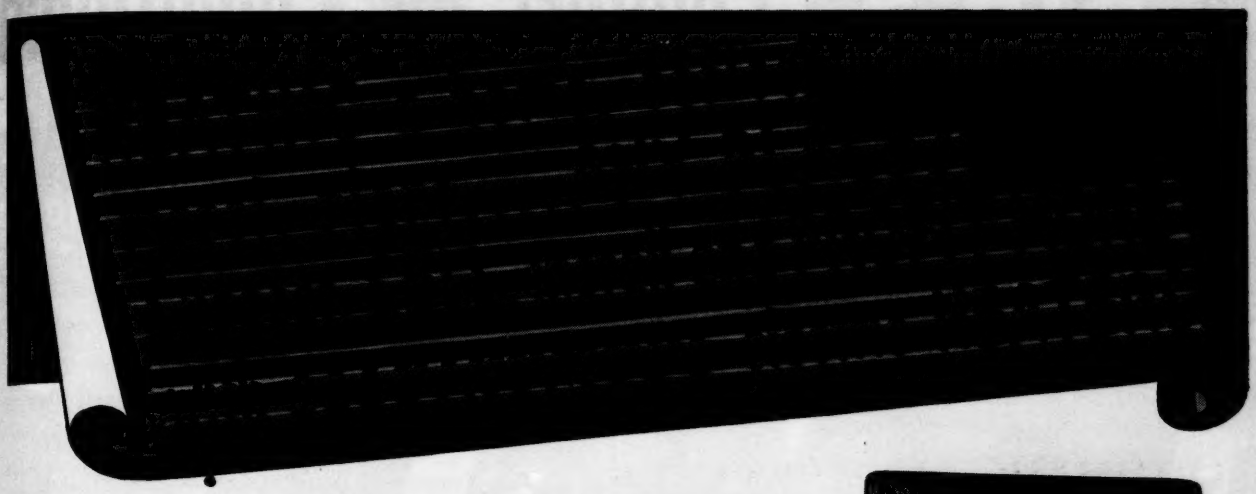
Representatives in Principal Cities

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

# DOLLINGER CORPORATION

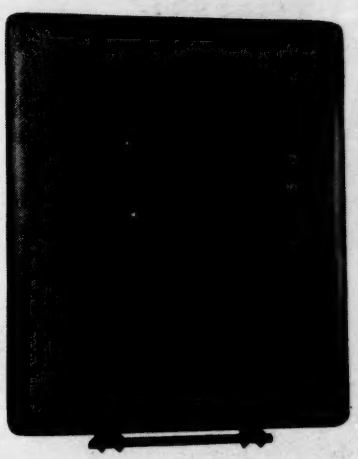
15 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

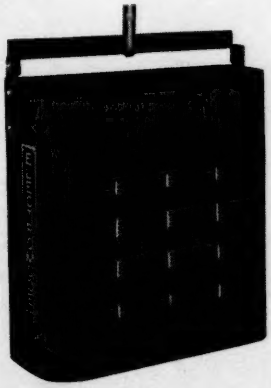


## For HOMES, OFFICES, MOTELS, STORES

. . . old or new specify, sell and install Electromode Electric Automatic Wall Heaters. Here's why you'll profit . . . because Electromode offers Economy-Convenience-Comfort and Safety . . . these are outstanding features of the modern Electromode Automatic Wall Heaters. *Economical* . . . because electric heating is low-cost heating. *Convenient* . . . because each heater has its own thermostat for individual room temperature control. *Comfortable* . . . because it takes only seconds for heat to circulate by the exclusive "Down-Flo" principle . . . at floor level. *Safe* . . . because only Electromode has the long-life, cast-aluminum heating element. There is *no* danger of fire, shock or burn. Yes, these and many other PLUS FEATURES are to be enjoyed with Electromode Heaters.



AUTOMATIC DOWN-FLO MODEL WA 1500 TO 4000 WATTS

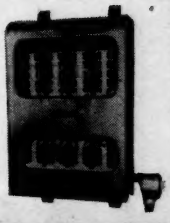


## For PLANT, OFFICE, WAREHOUSE

For any plant or office heating problem, any hard-to-heat area, choose Electromode Unit Space Heaters. These all electric heaters are available in all sizes and capacities from 1500 to 45,000 watts to fit any heating problem. They can be located anywhere that electric wiring can be strung. Equipped with automatic temperature controls and built-in safety switch, means economy of operation and absolute safety from fire, shock or burn. The exclusive patented cast-aluminum heating elements will not rust or corrode. Electromodes provide an abundance of fan-circulated heat when and where it is needed. Approved by Underwriters' Laboratories and thousands of commercial and industrial plants throughout the country.

## For HAZARDOUS AREAS EXPLOSION-PROOF HEATERS

The only Electric Explosion-Proof Heater of its kind approved by Underwriters' Laboratories. Features Electromode patented cast-aluminum heating element. Specially designed for installation in hazardous areas where heat is required and danger of explosion exists. Available in 2000, 4000, 6000 watt capacities.



## FREE CATALOGS

. . . on Domestic, Commercial and Industrial Electric Heating, full of specifications, illustrations, installations, diagrams, and how to figure electric space heating. Send NOW—All New.

NAME_____

TITLE_____

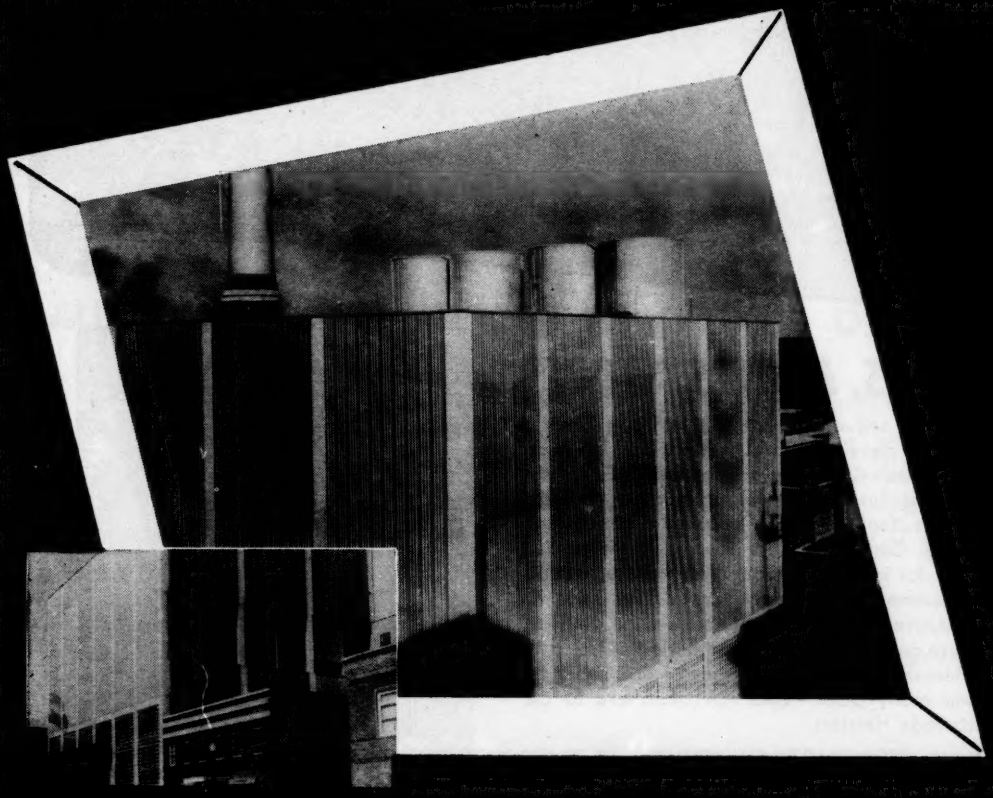
ADDRESS_____

CITY_____ ZONE____ STATE_____

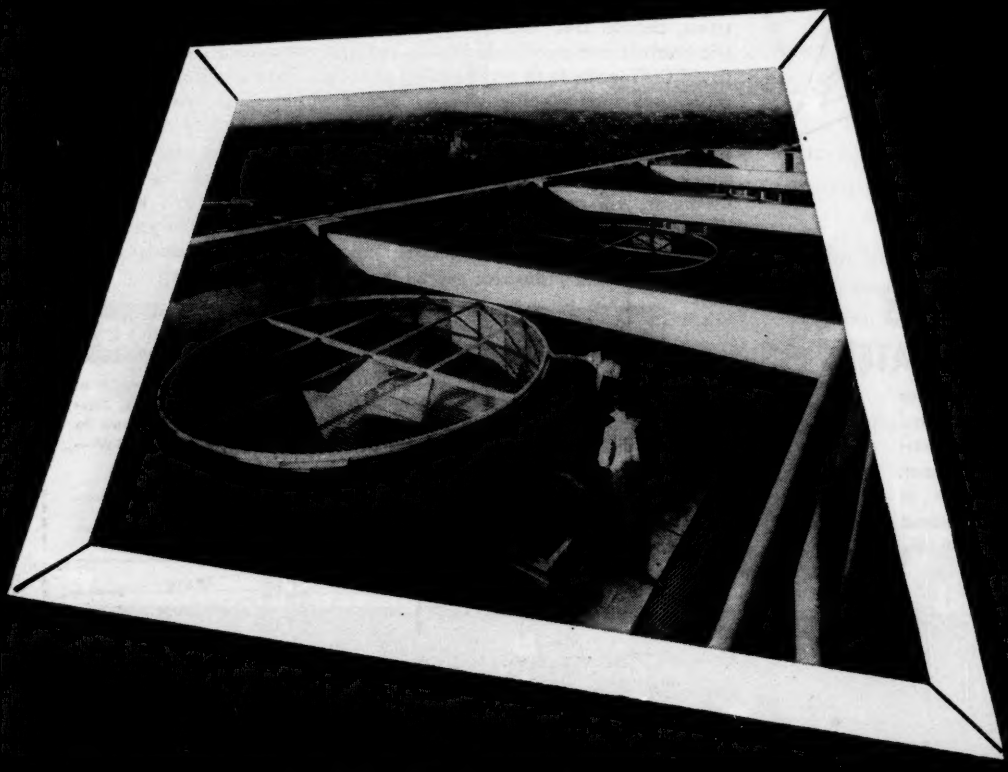
ELECTROMODE
All Electric HEATERS

# The Big 3 Comfort Air Conditioning

The Biggest



The Highest



# Towers of 1951 — All Built by PRITCHARD!

The "Big 3" *comfort* air conditioning cooling towers of 1951 had many things in common. Each tower is the critical "heart" of the system it serves—a heart which must function for many many years with unfailing reliability. Each tower was engineered by Pritchard to meet widely varying individual specifications and operating conditions. And each tower installation had these major considerations thoroughly engineered for specific function:

**Sound Control • Ice Formation • Fog Dissipation**
**Condensate Control • Drift Elimination**

**Algae Control • Bacteria Control • Fungi Control**

**Thermal Capacity • Mechanical Reliability**

**Architectural Appearance • Operating Flexibility**
**Maintenance Facility**

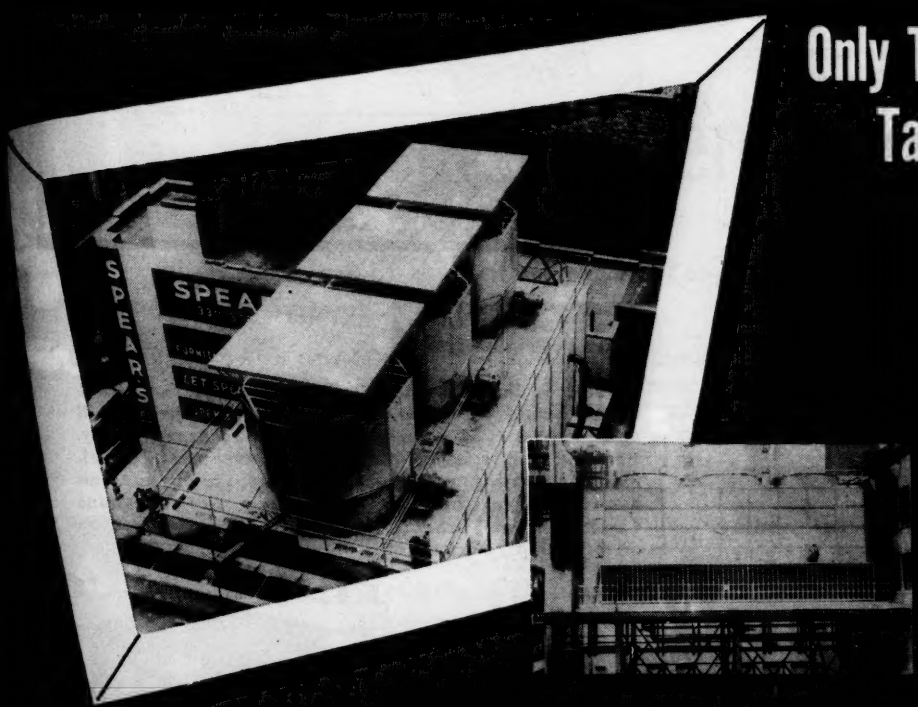
**Personnel Safety • Insurability • Fire Hazards**
**Material Compatibility • Structural Stability**
**Building Code Conformance**

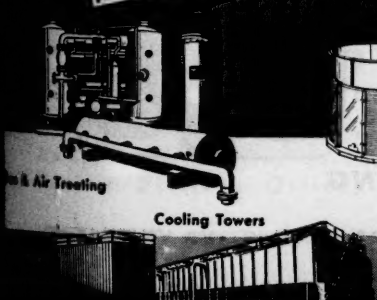
The fact that these problems were all resolved to the satisfaction of all concerned is outstanding evidence of Pritchard's ability to coordinate architectural treatment, mechanical equipment, engineering "know-how" and modern construction methods into an *outstanding* cooling tower installation.

Regardless of the complexities of your cooling tower problem, you can rely on Pritchard's proven experience and ability in this field.

**We invite your specific inquiry.**

## Only Tower for World's Tallest Building



QUALITY Specialized Process EQUIPMENT

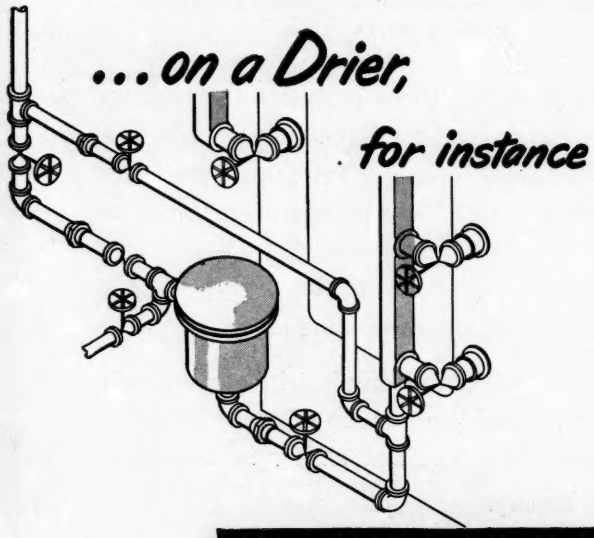
**J.F. Pritchard & Co.**

**EQUIPMENT DIVISION**

Dept. 244 — 908 Grand Ave., Kansas City 6, Mo.

District Offices: CHICAGO • HOUSTON • NEW YORK • PITTSBURGH

# Example of Steam Trap Durability




## THE INSTALLATION

On heavy-duty, steam-heated tumbler-type drier at American Linen Supply Company, Cincinnati.

## THE HISTORY

A high discharge capacity trap was needed to operate this drier 16 hours daily under heavy loads, with 125 psi. steam. Specifications called for rapid, fully automatic condensate removal to insure fast warm-ups and a steady flow of hot, dry steam to the drier. Naturally, the lowest possible trap maintenance cost was also wanted.

The choice was a Crane 150-Pound Inverted Open Float Steam Trap, carefully selected for adequate drainage capacity, and above all, properly installed.

In service more than 8 years and never needing any repairs or new parts, the Crane trap has given complete satisfaction. Total maintenance expense: periodic routine inspection only.

## TRAP SERVICE RATINGS

**SERVICE LIFE:**
More than 8 years - Heavy duty

**SUITABILITY:**
High discharge capacity

**MAINTENANCE COST:**
None - Routine inspection only

**SPECIAL FEATURES:**
Simple, dependable mechanism

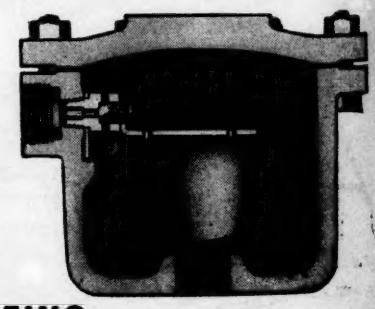
**OPERATING RESULTS:**
Fast warm-ups - Steady, even heat

**PRICE:**
Good Buy

**AVAILABILITY:**
Stock item in Crane line

## THE TRAP

Crane Iron Body Inverted Open Float Steam Trap, for 1 to 300 pounds saturated steam working pressures. Small and compact in all sizes, yet has high discharge capacity. Patented ball-type seating gives positive pressure seal. Simple operating mechanism with only one moving unit assures durable, trouble-free performance. See your Crane Catalog or your Crane Representative for complete data on these highly efficient traps.

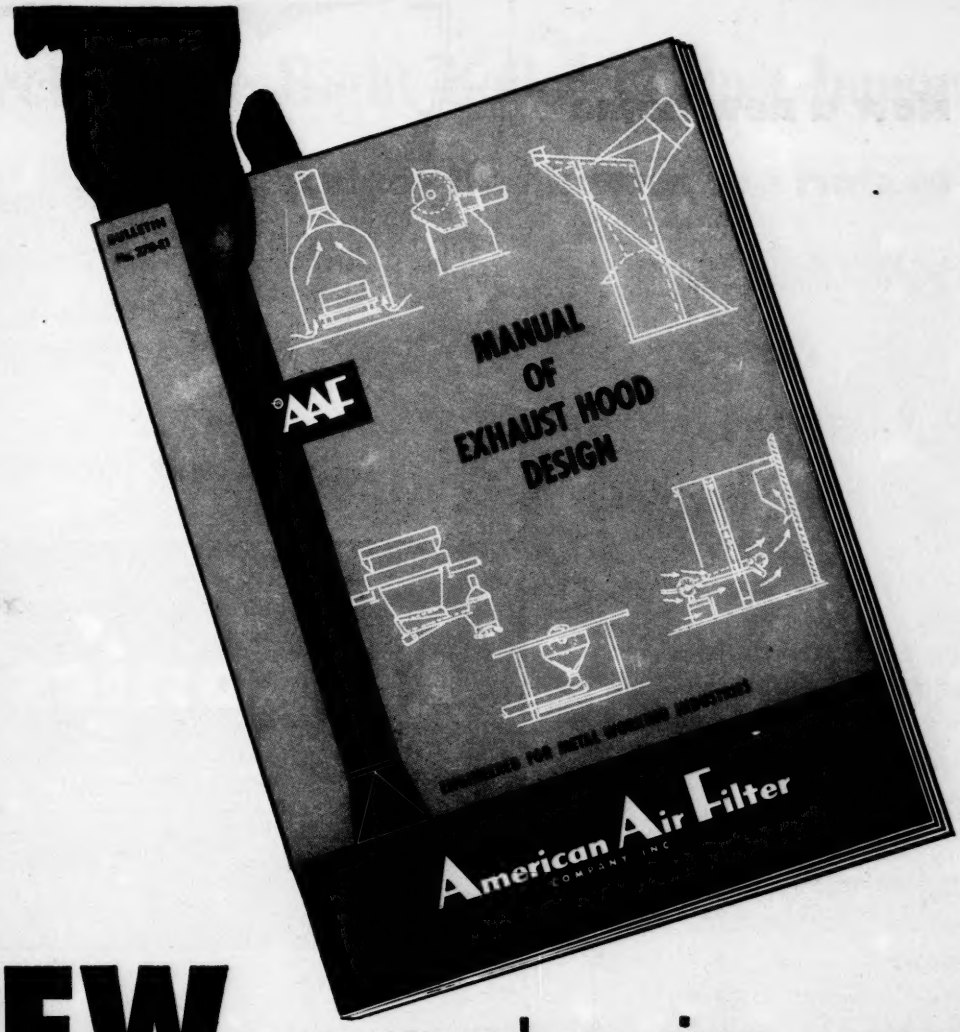


***The Complete Crane Line Meets All Valve Needs. That's Why,***
**More Crane Valves Are Used Than Any Other Make!**

# CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
*Branches and Wholesalers Serving All Industrial Areas*

***VALVES • FITTINGS • PIPE • PLUMBING • HEATING***




# NEW comprehensive manual

**. . . for increased efficiency of Dust Control Systems.**

AAF's new Manual of Exhaust Hood Design is the most complete engineering reference of its kind. Twenty-four pages of factual information; tables of exhaust requirements; dust concentrations and weights of collected material; and 61 photographs covering hood designs and applications for the metal working industries. Special sections include:

- Polishing, Buffing, Grinding and Allied Operations
- Portable and Flexible Shaft Grinding and Polishing
- Cast Iron Machining
- Automatic Buffing
- Oil Mist Control

AAF

We will gladly send you this new Manual of Exhaust Hood Design without obligation. Why not fill out the coupon right now?

**American Air Filter**
**COMPANY, INC.**
215 Central Avenue, Louisville 8, Ky.
American Air Filter of Canada, Ltd., Montreal, P. Q.
Pacific Division Office, San Francisco, California

American Air Filter Company, Inc. C
215 Central Avenue
Louisville 8, Kentucky

Please send me your new Manual of Exhaust Hood Design—Bulletin No. 270-E1.

NAME_____

TITLE_____

COMPANY_____

CITY_____ STATE_____

**Now a new name**

**to start our second half century . . .**

**CHICAGO METAL HOSE CORPORATION**

**Flexonics** *Corporation*

**Sales operations are divided into four logical divisions**

**CHICAGO METAL HOSE DIVISION**

Corrugated and convoluted flexible metal hose, machine tool conduit, refrigeration conduit, "Vibra-Sorber" vibration eliminators for piping, and assemblies for specific applications.

**AIRCRAFT DIVISION**

Stainless steel aircraft components including hose of all types, bellows, oil and fuel lines, air lines, ducting and connectors of all types and many special assemblies for jet aircraft.

**FLEXON BELLOWS DIVISION**

Stainless steel bellows, brass and bronze bellows, automobile thermostats and bellows and bellows assemblies and devices for all types of standard and specialized applications.

**EXPANSION JOINT DIVISION**

Standard corrugated packless type expansion joints in free-flexing and controlled-flexing construction, high pressure Flexoniflex expansion joints, heat riser expansion joints, and special joints.

• In 1947, Chicago Metal Hose Corporation introduced to industry a new science—the science of Flexonics. It is defined as the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion. This definition so well describes our operations and the expanding range of our products that we are adopting it as our corporate name coincident with our 50th anniversary year.

Let us assure you, however, that the change from Chicago Metal Hose Corporation to Flexonics Corporation involves no change in management, personnel or methods of operation except for internal organizational changes that will make it possible for a fast growing company to serve its customers better.

**Flexonics** *Corporation* 1326 S. THIRD AVENUE • MAYWOOD, ILLINOIS

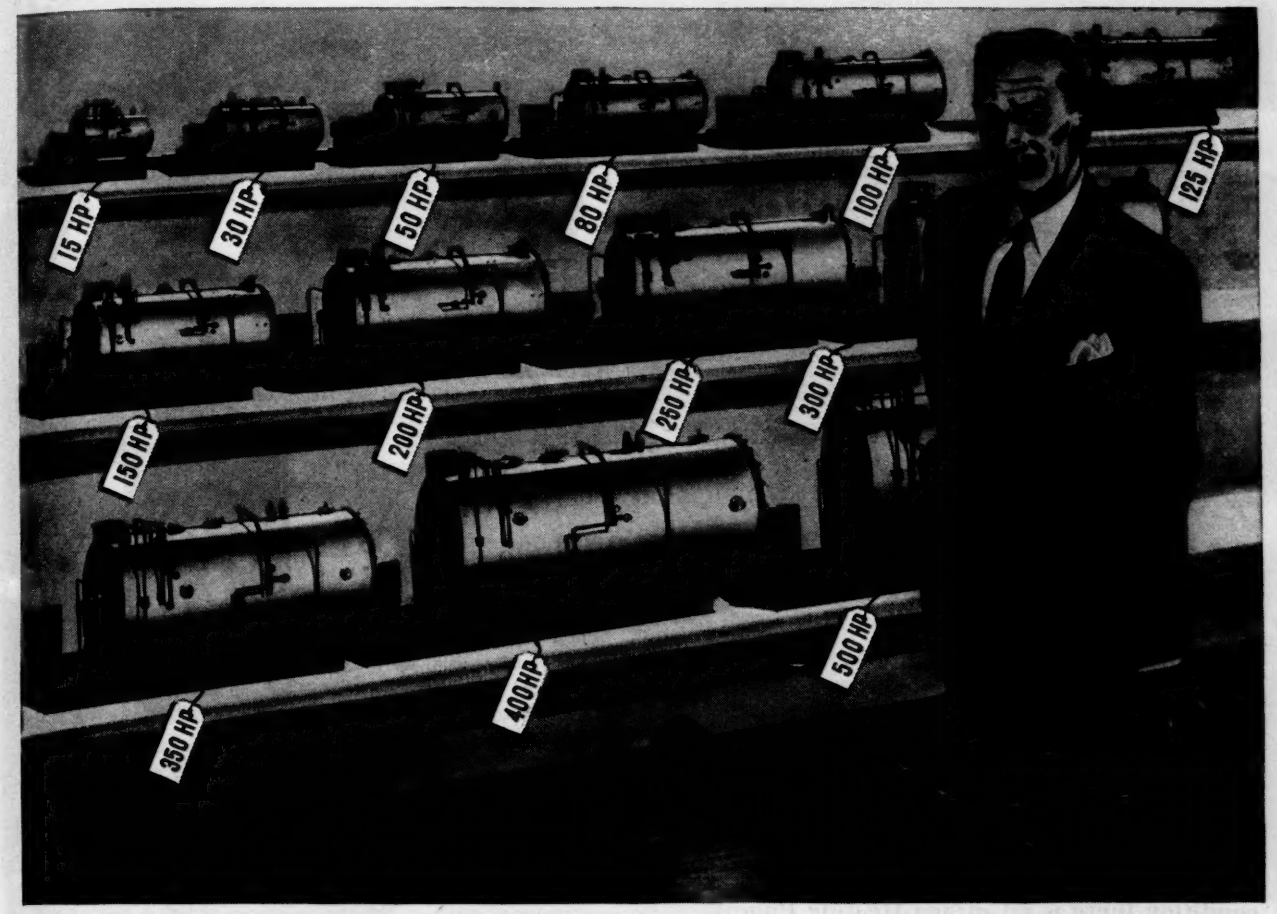
**FORMERLY CHICAGO METAL HOSE CORPORATION**

Flexon identifies CMH products that have served industry for over 50 years.

Manufacturers of Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems • Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

# Selecting The Right Boiler Is Most Important...

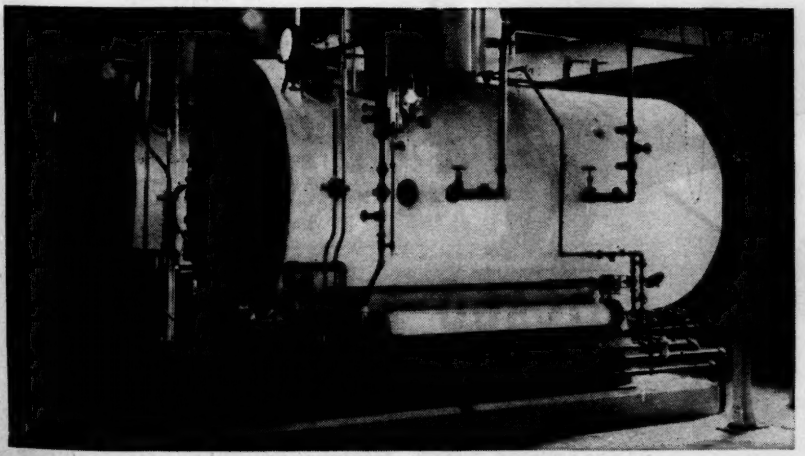



Cleaver-Brooks does not sell steam boilers "off the shelf" even though the boilers are available in standard models. Working with you, your engineers, and your consulting engineers Cleaver-Brooks helps analyze your particular steam needs and loads, both present and future.

These are a few of many factors considered: steam requirements in pounds per hour or b.h.p. — constant or fluctuating loads — fuels available — electric current characteristics — space and boiler room layout — provision for expansion.

Application engineering assistance of this kind assures you a steam plant tailored for your job. Cleaver-Brooks are the first and finest in modern, self-contained steam boilers — operate at a guaranteed efficiency of 80% — burn the fuel most available and economical in your area, gas, oil, or combination gas and oil — fully meet all codes — standard models available in sizes 15 to 500 hp; 15 to 200 p.s.i.

*Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler catalog.*



# Cleaver-Brooks

**STEAM BOILERS**

CLEAVER-BROOKS COMPANY
Dept. C-314 E. Keefe Ave., Milwaukee 12, Wis., U.S.A.
Cable Address: Clebro-Milwaukeewis

*Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners*

# THE CHICAGO PUMP IS A BETTER PUMP

**Figure V 9500**—Type AVC Condensation Pump and Receiver. Receiver serves as base. Low inlet — suitable for floor mounting or shallow pit. No foundation bolts necessary. Ask for Bulletin 245.

**Figure L 9700**—Type CLL1 Vertical Condensation Pump. Extra heavy duty unit. Specifically designed for low return service and underground installations. Ask for Bulletin 255.

## . . . For Every Heating Purpose

Get the pump that is specifically designed for the particular job. For below floor returns, for low vacuum systems, for small capacity high pressure requirements, for any standard heating system or any unusual condition there is a Chicago Heating Pump that will do the job better.

*All ratings and receiver capacities meet or exceed ASHVE standards.*

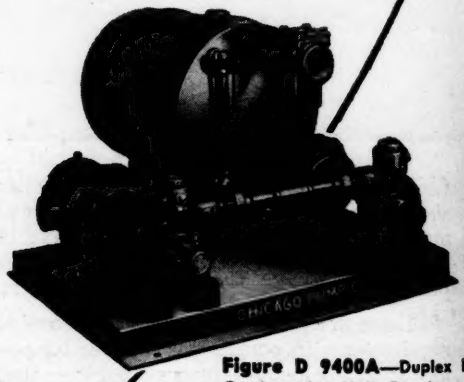
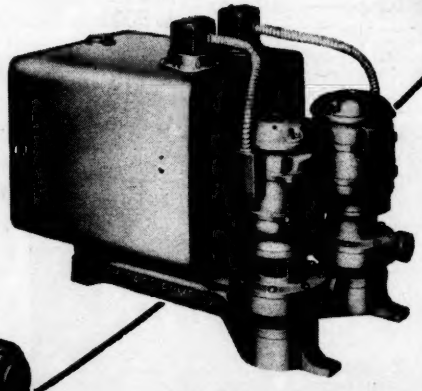


**Figure D 9400A**—Duplex FC Condensation Unit. For duty up to 50,000 EDR and discharge pressures up to 150 lbs. Ask for Bulletin 260.

**Figure D 9900**—Duplex Condo-Vac Return Line Vacuum and Boiler Feed Pump for vacuum heating systems. Pressures up to 40 lbs., and from 2500 to 150,000 EDR. Ask for Bulletin 270.



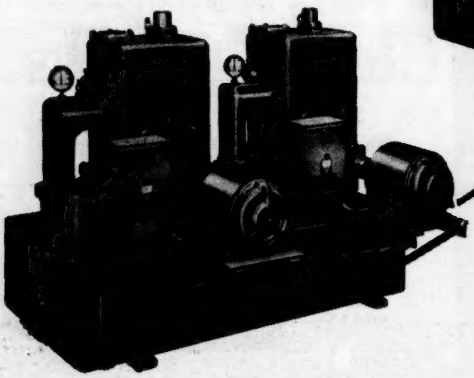


**Figure D 9200**—Sure Return Condensation Pump and Receiver. For systems up to 75,000 EDR and for low and medium pressures. Available in either single or duplex units. Ask for Bulletin 250.

# CHICAGO PUMP COMPANY

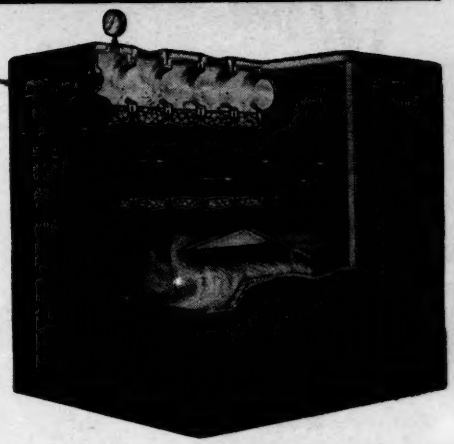
**BUILDING and INDUSTRIAL DIVISION**

**622 DIVERSEY PARKWAY** — **CHICAGO 14, ILLINOIS**

Condo-Vac, Sure Return. AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems.

Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use.

# AMERICAN-Standard
## HEATING

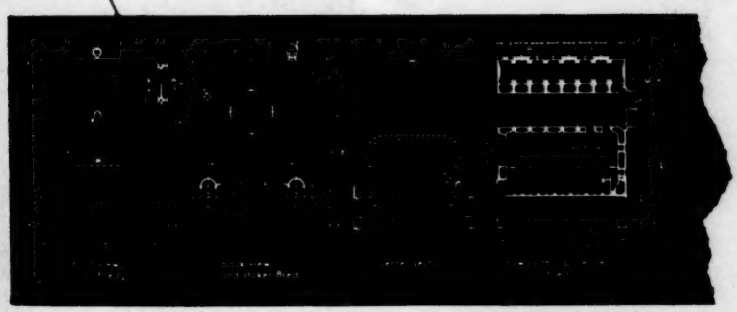


## Improved design makes New No. 3 REDFLASH Boiler *better than ever!*

● Incorporating a heat-saving combination of finned heating element, correctly designed baffles, and long flue travel, the *new* No. 3 Redflash is an even greater boiler than before.

Made in models and sizes to meet the heating requirements of large homes, apartment houses and commercial establishments, these durable cast iron boilers can also be installed in battery to provide an extremely flexible heating plant for larger buildings. Available for steam or hot water heating, No. 3 Redflash burns all fuels. American-Standard heating equipment is sold through selected wholesale distributors to heating and plumbing contractors.

## *Quality Construction! Precision Engineering!*



**DIMENSIONS, OUTLETS, INLETS**
**Tapped 2" for External Water Heater**

| BOILER NUMBER | | Outlets Number and size | Inlets Number and size | DIMENSIONS—INCHES | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Steam | Water | | | B | C | D | E | F | G | H | L† |
| 3-S-6* | 3-W-6* | 2 4" | 2 5" | 18 | .. | .. | .. | .. | 9 | 29⅜ | 36 |
| 3-S-7* | 3-W-7* | 3 4" | 2 5" | 12 | 12 | .. | .. | .. | 9 | 35⅜ | 42 |
| 3-S-8 | 3-W-8 | 3 4" | 2 5" | 18 | 12 | .. | .. | .. | 9 | 41⅜ | 48 |
| 3-S-9 | 3-W-9 | 4 4" | 2 5" | 12 | 12 | 12 | .. | .. | 9 | 47⅜ | 54 |
| 3-S-10 | 3-W-10 | 4 4" | 2 5" | 12 | 12 | 12 | .. | .. | 15 | 53⅜ | 60 |
| 3-S-11 | 3-W-11 | 4 4" | 2 5" | 12 | 18 | 18 | .. | .. | 9 | 59⅜ | 66 |
| 3-S-12 | 3-W-12 | 5 4" | 2 5" | 18 | 12 | 12 | 12 | .. | 9 | 65⅜ | 72 |
| 3-S-13 | 3-W-13 | 5 4" | 2 5" | 18 | 18 | 12 | 12 | .. | 9 | 71⅜ | 78 |
| 3-S-14** | 3-W-14** | 6 4" | 2 5" | 12 | 12 | 18 | 12 | 12 | 9 | 77⅜ | 84 |

*Coal, hand fired only. **Oil Fired (3-S or W-14-0) and Stoker (3-SC or WC-14) only.
†On Hand Fired add 21" to length for Smoke Hood. On Oil and Stoker Fired add 3¼" for Smoke Collar.

The new No. 3 Redflash is carefully designed and sturdily constructed for many years of completely automatic, carefree service. Note these important features as illustrated above:

Large disengaging area provides dry steam for fast, noiseless heating. Finned heat absorbing surface exposed directly to fire for extra efficiency. Refractory baffles bring hot flue gases into intimate contact with finned crownsheet. Scientifically designed and proportioned combustion space for greater efficiency. Flue passages provide exceptionally long flue travel and extract maximum heat from hot gases.

*The* AMERICAN-Standard *line means more business for you in '52!*

**American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pa.**

*Serving home and industry*

# THE SMOKE-ROD TEST PROVES

# Oran's New Dual-Air Burner is SUPER CLEAN

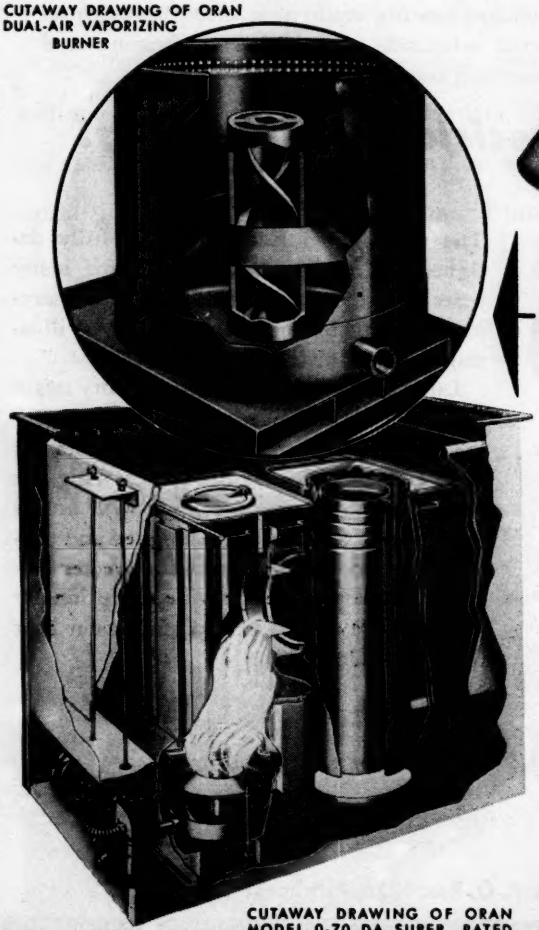
**THIS ROD MEETS COMMERCIAL STANDARDS REQUIREMENTS**

This is a 6% smoke rod, which means there is a 94% build-up of carbon on a glass rod inserted in the smoke pipe of an oil furnace with ordinary vaporizing burner for 20 minutes, at .06 draft. *This is the acceptable standard which all such burners must achieve to meet commercial standards.*

**THIS ROD MEETS ORAN REQUIREMENTS**

Here is the same test performed in an Oran Model 0-70DA oil-fired floor furnace with *dual-air vaporizing burner.* Note that smoke rod is super clean, with perfect light transmission. *This test was made at .02 draft, a 67% reduction in draft requirement!*

CUTAWAY DRAWING OF ORAN DUAL-AIR VAPORIZING BURNER



## ALL ORAN Shallo-Well, oil-fired floor furnaces have the REVOLUTIONARY, CLEAN-BURNING, DUAL-AIR BURNER

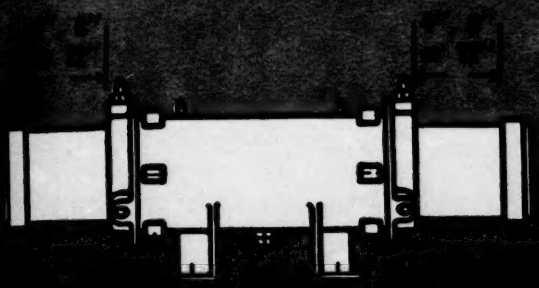
Here's the authoritative LABORATORY TESTED proof that Oran Shallo-Well, oil-fired floor furnaces with the sensational, new Dual-Air vaporizing burner, burn clean and soot-free, EVEN AT 67% DRAFT REDUCTION. After years of extensive research, Oran now brings you an oil-fired unit that matches the cleanliness of natural gas! Let us send you the complete story on the revolutionary, new Dual-Air burner, and why it makes Oran the unquestioned leader in oil-fired floor furnaces. You can't afford to let another day pass without investigating the Oran Shallo-Well line—your magic key to floor furnace profits! *Write, wire or phone us TODAY!*

UNDERWRITERS' LISTED

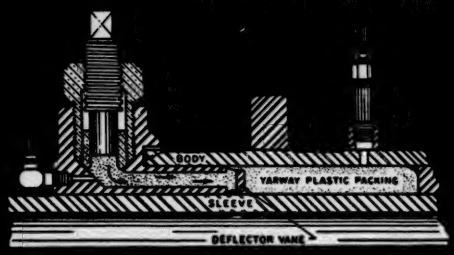
CUTAWAY DRAWING OF ORAN MODEL 0-70 DA SUPER, RATED AT 75,000 BTU. OTHER MODELS AT 50,000 AND 65,000 BTU.

**ORAN COMPANY**
2212 S. Third Street, Columbus 7, Ohio

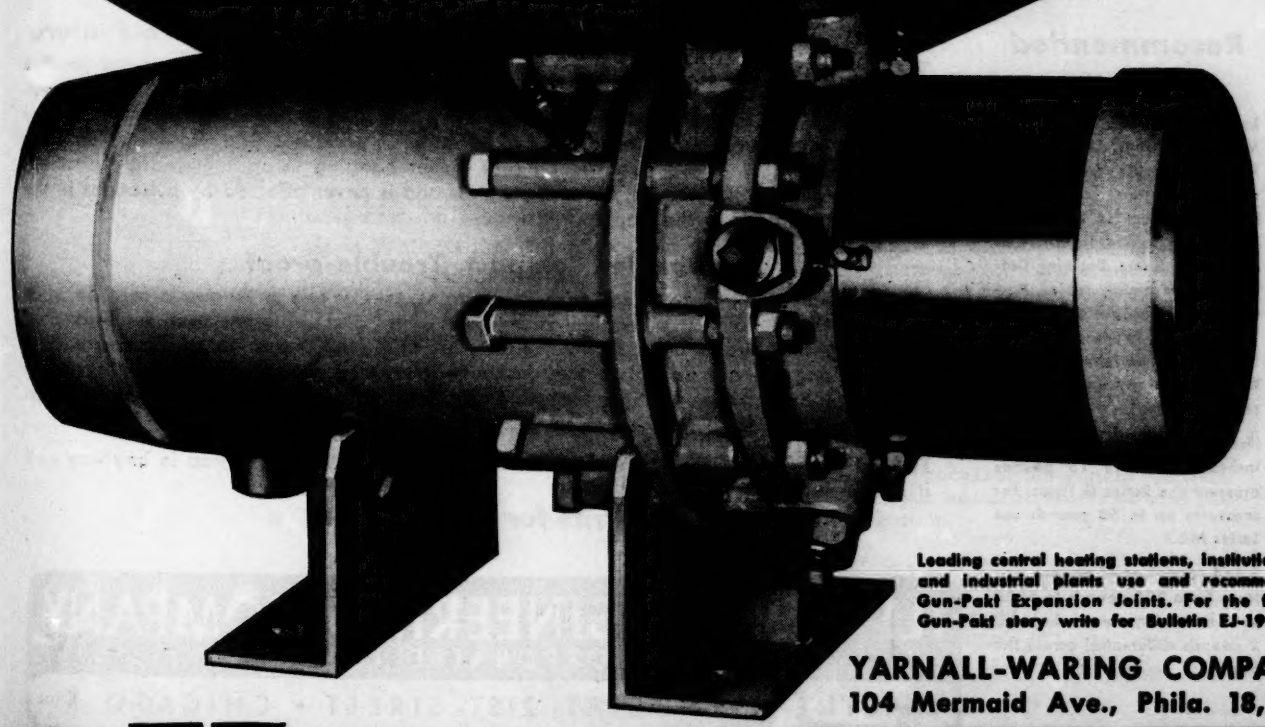
# YOU NEED FEWER JOINTS



# AND LESS MAINTENANCE




# GUN-PAKT

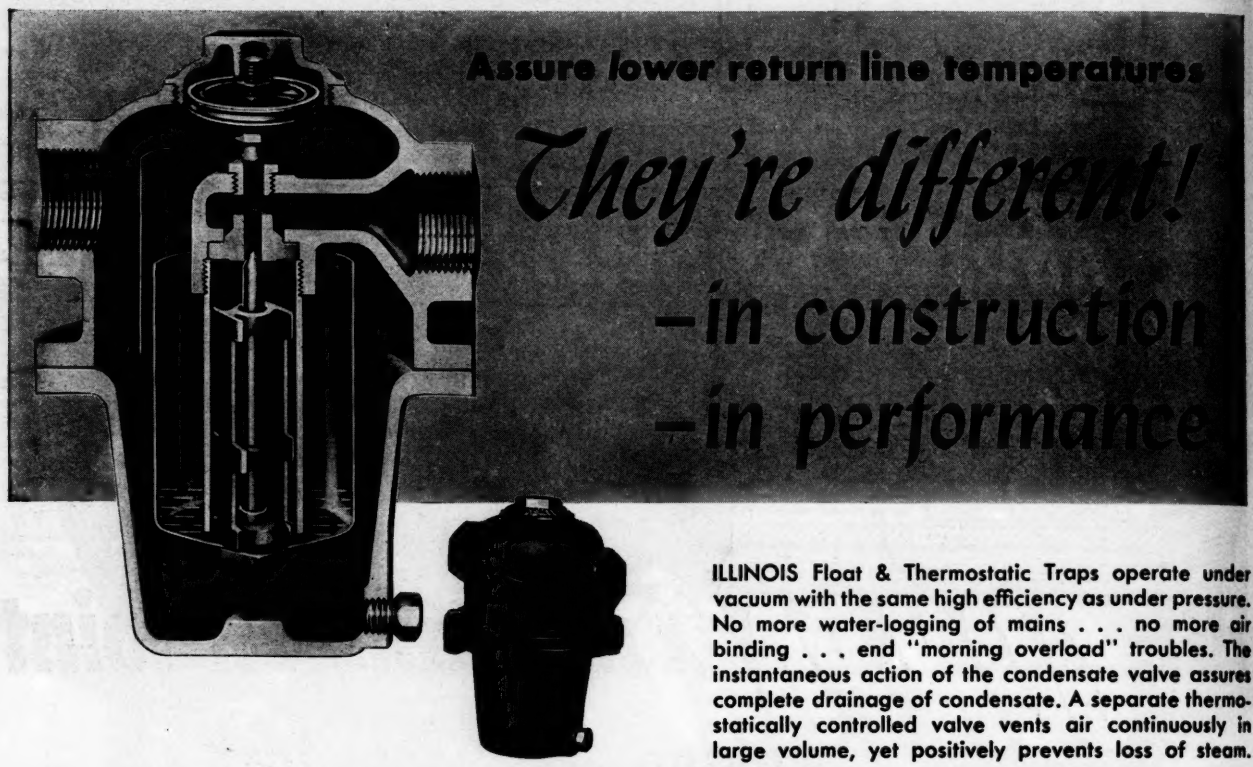


Leading central heating stations, institutions and industrial plants use and recommend Gun-Pakt Expansion Joints. For the full Gun-Pakt story write for Bulletin EJ-1912.

**YARNALL-WARING COMPANY**
**104 Mermaid Ave., Phila. 18, Pa.**

**YARWAY** GUN-PAKT EXPANSION JOINT

# ILLINOIS
## Float & Thermostatic TRAPS




ILLINOIS Float & Thermostatic Traps operate under vacuum with the same high efficiency as under pressure. No more water-logging of mains . . . no more air binding . . . end "morning overload" troubles. The instantaneous action of the condensate valve assures complete drainage of condensate. A separate thermostatically controlled valve vents air continuously in large volume, yet positively prevents loss of steam.

### *Recommended Applications*

Low Pressure Heating Systems, Ventilating Units, Unit Heaters, Pre-Heaters, Re-Heaters, and other Fan System Heat Surface, Large Radiators or Pipe Coils, Hot Water Generators, Drips of Mains and Risers. Draining Coffee Urns, Warming Tables, Pasteurizers, Vacuum Pans, Heat Exchangers, Process Heaters, Sterilizers, Autoclaves, Cooking Kettles, Kilns and similar equipment.

(For operating ranges from 25 inches vacuum to 15 pounds pressure use Series G Traps. For pressures up to 50 pounds use Series MG.)

Rated capacities of various size traps from 200 pounds to 5000 pounds condensate per hour, at 2 pounds differential across the trap.

### Positive, Instantaneous Valve Action . . . an Exclusive Feature

The Snap Action of the Condensate Control Valve assures efficient trap operation. The valve is not directly attached to float but is actuated by impact of the dropping float. Valve action is instantaneous whether the trap is handling its maximum capacity or only a trickle of condensate and regardless of variation in pressures. The valve is either wide open or tight shut—never cracked on seat, never hanging in an intermediate position. It is water-sealed at all times. It cannot chatter and is never affected by pulsations in the flow of condensate to the trap.

### Simple, Compact, Trouble-proof

No ball floats to puncture or collapse—no toggles, pins, levers or hinges to corrode, stick or bend. Hard, stainless alloy steel renewable valves and seats are used for both condensate and air bypass units. Both valve units are at the top of trap out of dirt and sludge, assuring long life and satisfactory operation without attention. Straight through connections save head room, fittings, trenching, labor, and avoid low hung piping or lifts. Trap is easily opened for inspection without disturbing piping.

**TRAP NOT DAMAGED BY FREEZING.** Freezing will not harm this trap in any way and it is self-thawing.

***Write for Bulletin 34-C***

**ILLINOIS ENGINEERING COMPANY**
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

# making FRIENDS fast

## The B&W Integral-Furnace Boiler, Type FM

**SHOP ASSEMBLED FOR SAVINGS**

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Suitable for Outdoor Service
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

**All the benefits of "packaged" steam are combined with the traditional economies and big boiler advantages of B&W's Integral-Furnace design in this compact, shop-assembled, ready-to-use unit. You can set it down wherever you want it, and set it up —ready to operate—in jig-time.**

**Already, well over 100 users in 24 broad industrial and commercial classifications in 29 states, two territories and 6 foreign countries have selected the B&W Integral-Furnace Boiler, Type FM, to produce a total 4,200,000 lb per hour of low-cost steam. Many of these users have placed repeat orders.**

**This popular self-contained unit is available for efficient heating and process steam-generation from 2900 to 28,000 lb per hr. at pressures to 250 psi. It's worth investigating.**

***Send for bulletin G-76 detailing advantages of this latest B&W creation in low-cost steam generation. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.***

**BABCOCK & WILCOX**

# MULTI-VENT

T.M. Reg. U.S. Pat. Off.

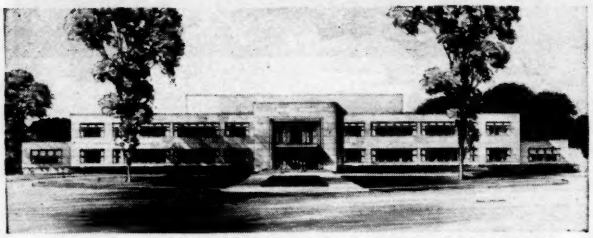
*low velocity air diffusion ceiling panels*

## a *premium* air distribution system

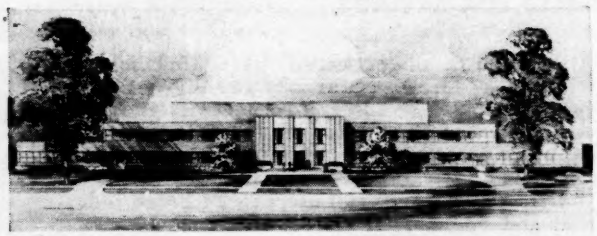
## *Specified for* dollar wise Insurance Companies

by Childs & Smith, Chicago
Architect-engineers for the four new buildings illustrated below

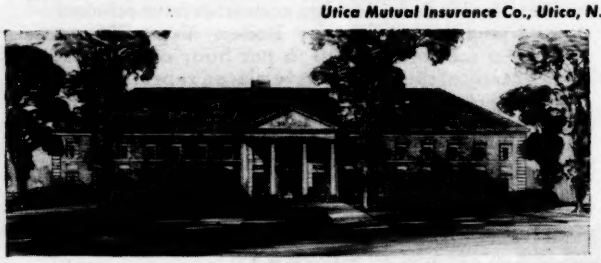
*Shelby Mutual Casualty Co., Shelby, Ohio*



*Farmers Mutual Automobile Insurance Co., Madison, Wisc.*



*Utica Mutual Insurance Co., Utica, N. Y.*



*Lumbermans Mutual Insurance Co., Mansfield, Ohio*

*Comfortable, complaint-free* air conditioned office spaces are an important factor in the productivity and employee relations of any company where office work plays an important role. That is why these insurance firms were readily convinced that their dollars were spent *wisely* on Multi-Vent panels for air distribution . . . a premium product which guarantees a superior, faultless performance worthy of their investment in the over all air conditioning system. For with Multi-Vent panels installed throughout, completely concealed in standard acoustical ceilings, a widespread, uniform air distribution is enjoyed free from all the hazards of drafts, noise and dirt. In addition the unique radiant panel heating or cooling effect of the Multi-Vent panel adds to the comfort factor.

Only Multi-Vent distributes air entirely by displacement rather than by high velocity injection. That means there are no strong air streams to aim and no change in air flow pattern when air supply is varied. Even with movable partitions and low ceilings, all problems of outlet location and direction adjustments for throw and drop to avoid drafts are eliminated . . . there simply are no drafts!

The use of Multi-Vent makes possible many sound economies in the basic heating, cooling, and air conditioning equipment in addition to substantial reductions in installation, maintenance, and redecorating costs. It pays to specify the finest in air diffusion systems . . . Multi-Vent. Write now for detailed literature and the name of the Multi-Vent sales engineer in your vicinity.

**MULTI-VENT DIVISION**

**THE PYLE-NATIONAL COMPANY**
1374 North Kostner Avenue — Chicago 51, Illinois

**Associated Architects:** Mayer & Whittlesey • Skidmore, Owings and Merrill
**Consulting Engineers:** Jaros, Baum & Bolles
**Heating Contractor:** J. L. Murphy, Inc.

# POWERS®

## ZONE TEMPERATURE CONTROL

***In this Outstanding Apartment Building***
***Assures Comfort, Dependability, Lowest Maintenance Cost***

**Temperature of hot water supply to convectors in this modern building is controlled by a Powers MASTROL System.**

**How It Operates**—A Powers Master Thermostat with its sensitive bulb in a special housing for sun-wind effect and outdoor temperature is located on outside wall of zone being controlled. It operates in conjunction with 4 Room Thermostats on the 4th, 9th, 14th and 19th floors of each zone through Averaging Relays to establish the control point for Series 100 Sub-Master Controllers. A manually operated switch on the main control panel is provided to raise or lower the control point when desired.

A program clock automatically reverts the controls to night operation during which period the outdoor Master Thermostat readjusts Series 100 Sub-Master Controller to a lower control point than used during day operation. Other types of Powers controls regulate various fans supplying heating and ventilating to other spaces in the building.

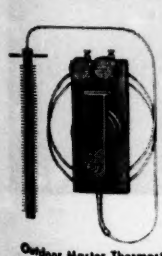
Type D Room Thermostat

**Experience gained by Powers in all types of prominent buildings will be helpful to you. When problems of temperature and humidity arise, contact our nearest office.**

**THE POWERS REGULATOR COMPANY, Skokie, Ill.**

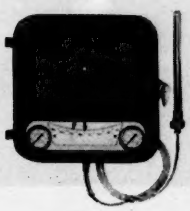
(a77)

**OVER SIXTY YEARS OF AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL** — **OFFICES IN OVER 50 CITIES**



Outdoor Master Thermostat

Averaging Relay



Indoor Sub-Master Controller

METAFLOW Control Valve

ACCRITEM Regulator

POWERSTROKE Damper Motor

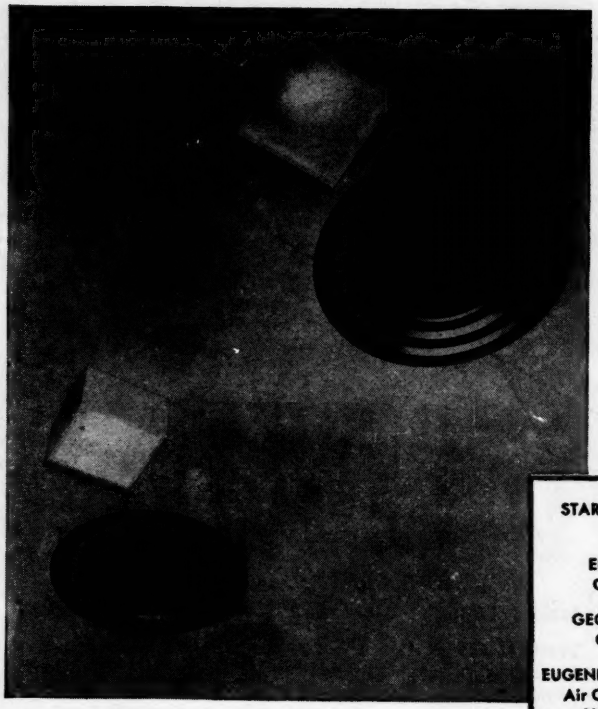
Pneumatic Switches

AIRSTREAM Thermostat

FLOWRITE Control Valve

*In America's outstanding buildings...*

*you'll find engineered* T&B *products*



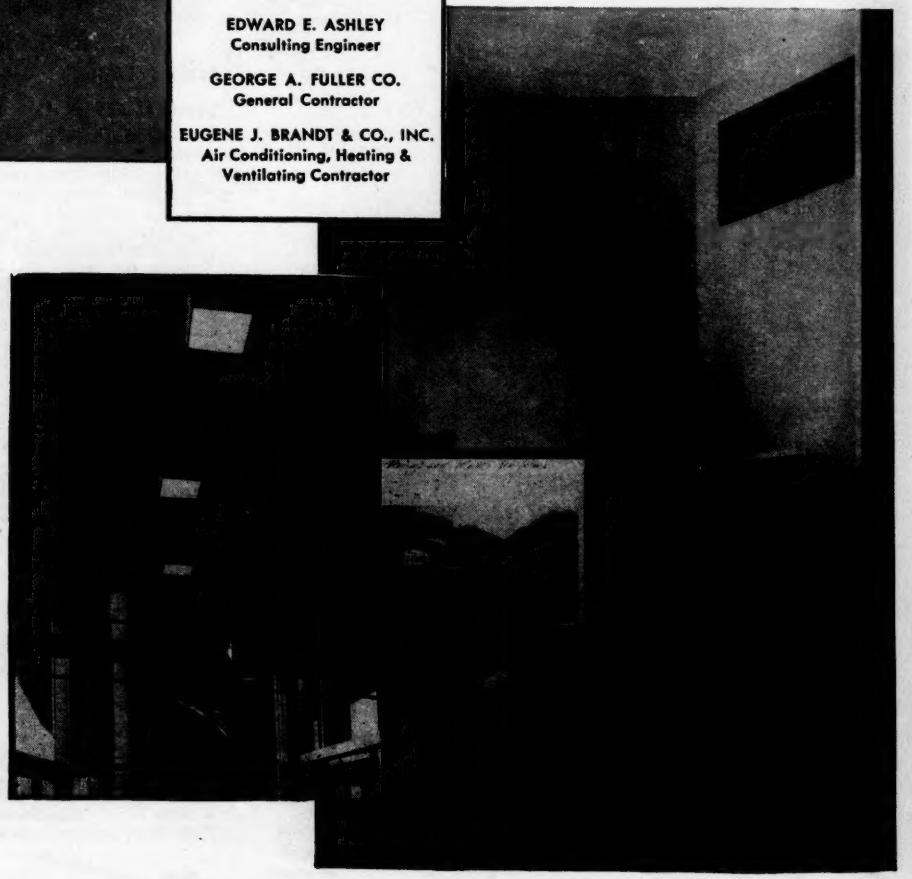
## *Aerofuse*
**CEILING DIFFUSERS**

STARRETT and VAN VLECK
Architects

EDWARD E. ASHLEY
Consulting Engineer

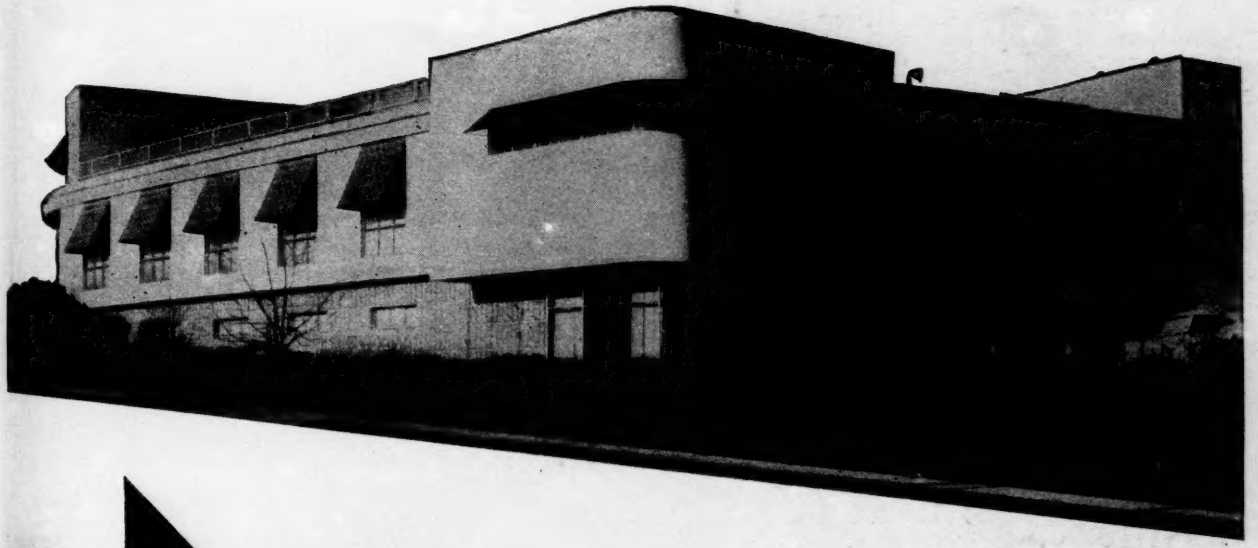
GEORGE A. FULLER CO.
General Contractor

EUGENE J. BRANDT & CO., INC.
Air Conditioning, Heating & Ventilating Contractor



## *Tri-Flex Aerovane*
**GRILLES** *and* **REGISTERS**

# INSTALLED AT THE VITAL POINT...OF AIR DELIVERY



## IN LORD & TAYLOR'S NEW STORE

***at Millburn, New Jersey***

No effort has been spared to make this luxurious new Lord & Taylor suburban store a delight to customers as well as a model of good practice in management and operation.

That means efficient, dependable air conditioning performance with the most careful attention to precision adjustment and control at the vital point of air delivery. As in so many other distinguished buildings from coast to coast, the architects and engineers specified Aerofuse Diffusers and Tri-Flex and Aerovane Grilles and Registers. These famous Tuttle & Bailey products, backed by the Industry's most complete engineering and test facilities, insure the performance of the system while meeting every requirement for good taste in design.

Write for Catalogs No. 104 and 48S containing full information.

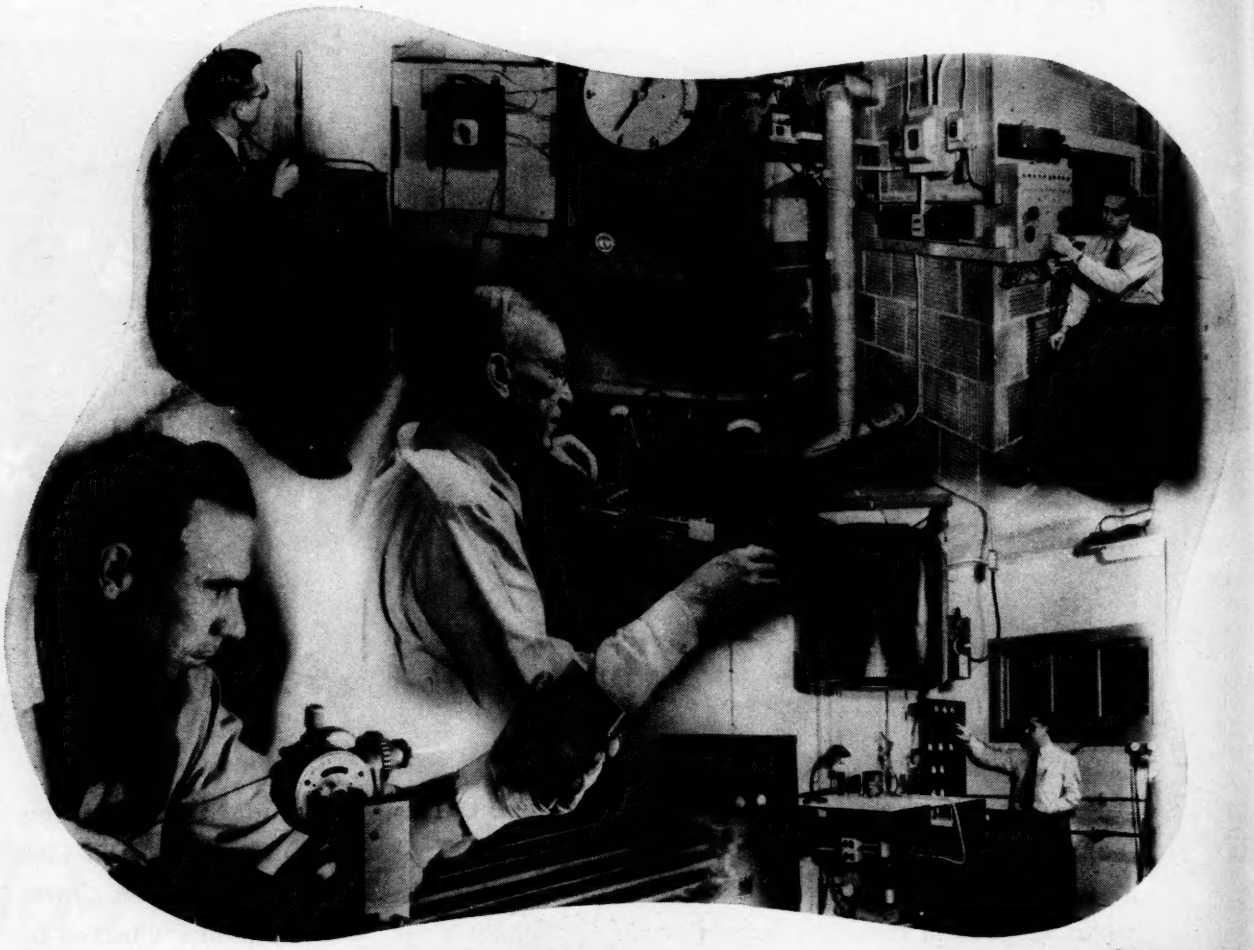
TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT

*Conquest of the elements, the electron harnessed, attack on illness—aspects of these and other accomplishments of special interest to architects and engineers are found in*

# Your Progress Report from Honeywell

*on the development of the science of temperature control*

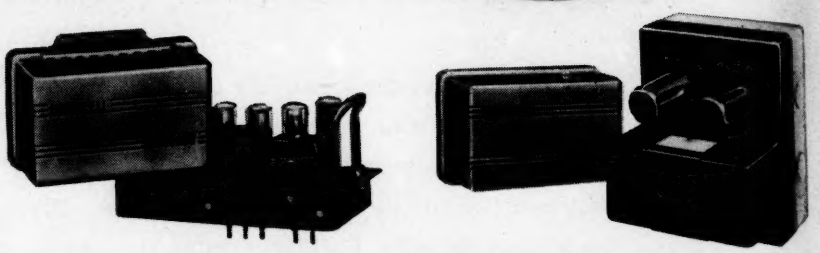


THERE'S a direct—and mighty important—relationship between the Honeywell products displayed on these two pages and the photo montage you see above.

Because one of the most important parts of Honeywell company policy from the beginning has been an insistence on thorough, painstaking research.

That's one big reason why Honeywell has been able to contribute so much to the development of the science of temperature control.

And that's why—when you specify Honeywell products like the eight shown here—you know you're giving your client the finest available anywhere.



## *The sensitivity of electronics applied to*

### *Air Conditioning Control*

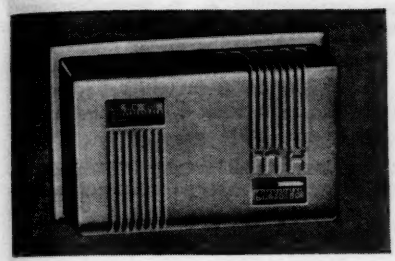
Here's a new system that enables you to give clients the ultimate in comfort—with increased efficiency and lower maintenance costs. Because it is *electronic*, it's *100 times as sensitive* as conventional systems—with faster reaction to changes in load, no temperature "overshoot," no waste of warm *or* cool air.

### *Humidity Control*

A system that out-performs them all! That's what Honeywell's new Electronic Humidity Control System does—with an accuracy that a few years ago was considered unattainable. Ideal for use where conditions demand absolutely *uniform* humidity, it's a *thousand times* more sensitive than ordinary systems.

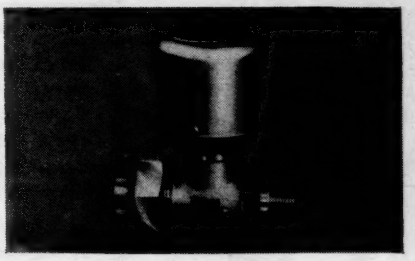
### *Weatherstat—compensates for wind, sun and exposure*

Here's a product unique with Honeywell—the Weatherstat—only outdoor control system of its kind. It's remarkably accurate because it meters heat not only in relation to outside temperatures, but to *wind and sun conditions as well!* This amazing control is designed for use on all larger buildings. Mounted out-of-doors, it gives highly effective temperature control *indoors* because it functions as a miniature of the building or area of the building it controls. And it saves up to 20% on fuel.



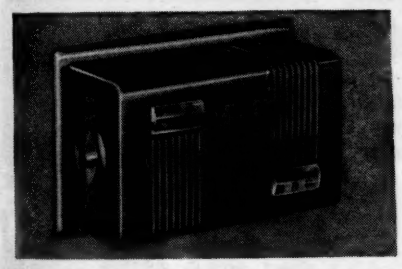
### *Shockproof equipment tested at sea*

Honeywell controls like the Grad-U-Stat shown above have passed the toughest use-test of all—service at sea. Experience gained in making vibration-proof, corrosion-proof sea-going controls has enabled Honeywell engineers to design controls that give a better, more satisfying performance in buildings ashore.



### *"Midget" Radiator Valve a great space saver*

Only *one-fourth* the size of conventional valves, the Midget Radiator Valve delivers top performance. Its compactness makes it ideal for concealed convectors—and for all other applications where you're pressed for space. And because of its small size, it's easier to install and maintain.



### *Only Thermostat specially designed for hospital use*

Designed to give maximum hospital efficiency, the Honeywell hospital thermostat offers many exclusive features. Features like the "*Nite-Glowing*" *dials* which permit inspection without disturbing patients; *magnified numerals* for easier readings; a *Speed-Set control knob* that's camouflaged against tampering.

### *Gradutrol Relay—first in its field*

This Honeywell-developed control has made possible a marked increase in efficiency of pneumatic air conditioning and fan ventilating systems. When used to control damper motors its positive positioning feature cuts down "lag," eliminates "overshoot"—giving your clients better, more even, more economical cooling. And in valve applications the Gradutrol Relay guarantees the most economical sequencing.

MINNEAPOLIS **Honeywell**

*First in Controls*

### *Automatic Reset Relay ends "cycling"*

When Honeywell engineers developed the Reset Relay (shown above, teamed with a Honeywell Grad-U-Stat), they opened the way to vastly improved pneumatic heating systems. For a pneumatic system incorporating this remarkable new control simply doesn't allow "seesawing" temperatures. The Reset Relay reduces offset by 90%, and allows wider throttling range settings, thus giving the system greater stability with no "hunting" or "cycling," and allows your clients to keep temperatures constant no matter how changeable the weather.

* * *

For additional information on how these Honeywell products and systems can help *you* better serve your clients, call your local Honeywell office. There are 91—located across the nation. Or fill in and mail the coupon below today.

MINNEAPOLIS-HONEYWELL
Dept. HV-3-62,
Minneapolis 8, Minn.

Gentlemen: Please send me further information on:

- ☐ Weatherstat
- ☐ Midget Radiator Valve
- ☐ Shockproof Controls
- ☐ Gradutrol Relay
- ☐ Electronic Air Conditioning Control
- ☐ Electronic Humidity Control
- ☐ Hospital Thermostat
- ☐ Automatic Reset Relay

*Name*.....

*Firm Name*.....

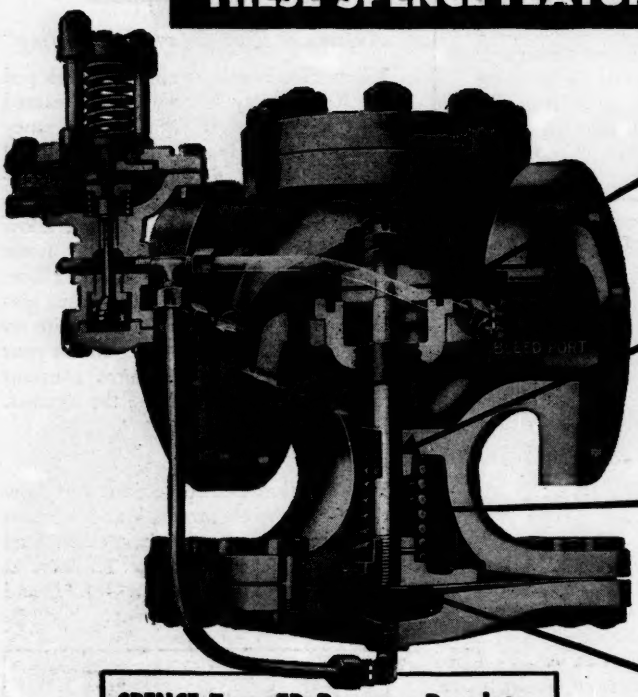
*Address*.....

*City*.....*Zone*.....*State*.....

HERE'S PROOF

# You Can Cut Costs of Pressure and Temperature Control

## THESE SPENCE FEATURES SHOW YOU HOW



SPENCE Type ED Pressure Regulator

**SECO METAL SEATS AND DISCS** — Durable SECO Metal resists wiredrawing. *More than twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

**PACKLESS CONSTRUCTION** — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

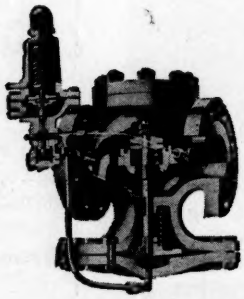
**SPRING OUT OF PATH OF STEAM** — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

**LARGE BALANCED DIAPHRAGM**—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

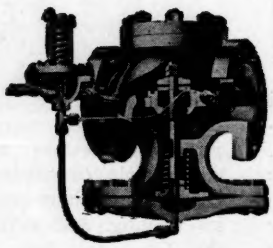
YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

Spence Pressure and Temperature Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.

Type ET150 Temperature Regulator—Tops in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator — Completely packless, pilot operated for accurate control of the initial pressure.

## These Companies Have Profited with SPENCE!

The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corporation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
Land O'Lakes Creameries, Inc.
General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

**and thousands of others**

**SPENCE ENGINEERING COMPANY INC.**
WALDEN, NEW YORK

Spence

**Cleveland's Shaker Towers chooses MODINE**

780 Modine Convectors provide individual room comfort for 92 suites. Architect: Joseph Ceruti. General Contractor: Roediger Construction Co. Heating Contractor: Spohn Heating & Ventilating Co.

# *America's finest buildings use America's finest convectors*

Modine Convectors come in three distinctive enclosures —Type F (shown) for free-standing or recessed installation, Types W and S for wall-hanging.

Today, superior heating performance must be teamed with subtle styling and long-life construction. On all counts, Modine Convectors meet the most exacting professional standards. That's why more and more Modine Convectors are being specified by leading architects and engineers. For full information on heating at its finest, call your Modine representative. You'll find him listed in your classified phone book. Or write Modine Mfg. Co., 1511 DeKoven Avenue, Racine, Wisconsin.

**Modine CONVECTORS**

R-1134

# Famous Labels suggest the choice

Many of the big textile mills . . . names your wife will recognize . . . "air-control" many of their manufacturing operations with Worthington air conditioning and refrigeration.

And many of the famous shops where the mills' products are sold . . . Saks Fifth Avenue, The Higbee Company, J. L. Brandeis, Lane Bryant, many Sears Roebuck Stores . . . are air-conditioned by Worthington.

No other manufacturer makes so complete a line. A Worthington system is all Worthington-*made*—not just Worthington-assembled—assuring you of perfectly balanced operation and unit responsibility.

Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, New Jersey.

America's Leaders... in Many Businesses... Select

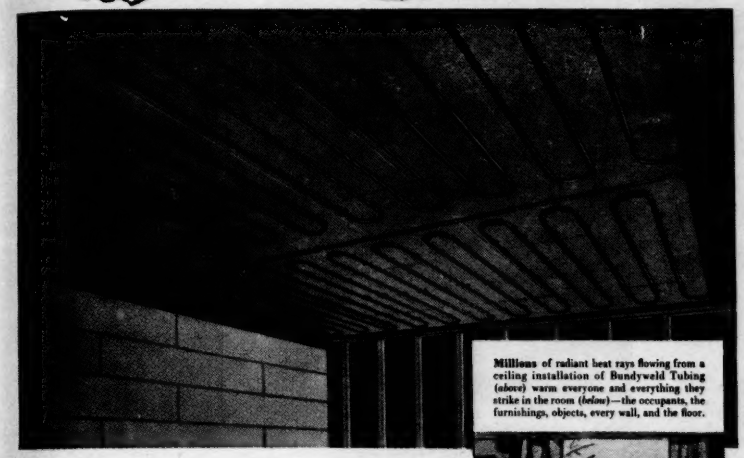
## WORTHINGTON

A.2.9

AIR CONDITIONING AND REFRIGERATION

The Most Complete Line... Always the Correct Recommendation

# "Choose ceiling radiant heating," says Bundy to future home owners—for you



Millions of radiant heat rays flowing from a ceiling installation of Bundyweld Tubing (*above*) warm everyone and everything they strike in the room (*below*)—the occupants, the furnishings, objects, every wall, and the floor.

## Like having the sun in your ceiling—Bundyweld ceiling radiant heating

**Have you** considered the many advantages of ceiling radiant heating for that home you are planning to buy, remodel, or build? This truly modern system offers you savings, conveniences, and comfort not matched by any other.

With *ceiling* installations of Bundyweld, for example, heat rays flow evenly, freely *downward*, not up through floors to be lost in rugs, furniture, draperies. Here is heating that really *radiates*, gently warming everyone and everything in the room. Heating so comfortable, so natural it's like having the sun in your ceiling.

**Savings, too**

More, because it's draft-free heat, less dust is carried onto upholstery, curtains, draperies. Because it's even heat, no dirt streaks form on walls or ceilings. You save extensively on dry-cleaning, wall-washing, and redecorating costs, enjoy easier day-to-day housekeeping.

These home maintenance economies, plus fuel savings over the first few years, more than pay for any additional first costs. Continuing yearly savings make this your most economical long-run heating system by far.

Talk to your real estate man, heating contractor, architect, or builder about radiant heating now. And about Bundyweld Tubing, too. Bundyweld is the *only* tubing double-walled from a single strip. It's tough steel tubing, copper-coated inside and out. Bundyweld is leakproof, takes high pressures in stride, transmits heat quickly.

*Send coupon for free booklet*

Send coupon at right for free booklet describing fully the many advantages of ceiling radiant heating. Radiant Heating Division, Bundy Tubing Company, Detroit 14, Michigan.

No radiators or registers to interfere with furniture arrangements or take up valuable floor and wall space.

**Bundyweld** is the only tubing double-walled from a single strip. It's quickly, easily fabricated into completed radiant heating grids—with major savings in time and construction costs

**BUNDY TUBING COMPANY**

Detroit 14, Michigan

WORLD'S LARGEST PRODUCER OF SMALL-DIAMETER TUBING

Radiant Heating Division
Bundy Tubing Company, Detroit 14, Michigan
Send me the free literature I've checked:
☐ Bundy consumer brochure on ceiling radiant heating
☐ Bundy technical brochure for the trade
Name_____
Company_____
Address_____
City_____ Zone_____ State_____

*First ad in new national campaign directed to future home owners.*

**It is the** conviction of Bundy Tubing Company that radiant heating systems rightly belong in *ceilings*.

Bundy tells future home owners *why* in an intensive, full-page, four-color campaign appearing in *Better Homes and Gardens* and *American Home*—magazines carrying immense weight with consumers interested in buying, building, or remodeling homes.

### Are you ready?

Interest in radiant heating has spurted sharply upward since the end of World War II. The all-new Bundy campaign is designed to give future home owners important information on *ceiling* radiant heating and on the Bundyweld Tubing features that help assure a perfect, long-lasting, economical system.

This campaign, of course, will help pave the way to even stronger consumer acceptance of ceiling radiant heating and Bundyweld Tubing. Result for architects and builders: Those who offer Bundyweld ceiling radiant heating systems will have a powerful, convincing, and much-wanted sales feature to speed sales to receptive buyers. Result for plumbing and heating contractors: Continually increasing business and good, sound profits from the installation of Bundyweld ceiling radiant heating systems.

***Radiant Heating Division***

**BUNDY TUBING COMPANY**

***Detroit 14, Michigan***

**The Bundy consumer brochure on ceiling radiant heating, to be offered in every national radiant heating ad, was written with you in mind, too. Let us send you a copy. It's packed with meaty facts.**

Radiant Heating Division
Bundy Tubing Company, Detroit 14, Michigan
Send me the free literature I've checked:
☐ Bundy consumer brochure on ceiling radiant heating
☐ Bundy technical brochure for the trade
Name_____
Company_____
Address_____
City_____ Zone_____ State_____

## Advantages of Bundyweld Tubing

Bundyweld is the only tubing double-walled from a single strip. It's steel, copper brazed through 360° of wall contact, copper-coated inside and out. It gives perfect radiant heating performance. Bundyweld transmits heat quickly. It's leakproof. Its smoothness and freedom from scale promote unimpeded water flow.

Bundyweld gives major fabrication savings, too. Bundyweld comes in 20' lengths for easy handling, one end expanded (when specified) for easy joining. Ductile Bundyweld bends easily on simple fixture. Lightweight, rigid grids of Bundyweld are easily, quickly mounted on ceiling.

# Famous Labels suggest the choice

Many of the big textile mills . . . names your wife will recognize . . . "air-control" many of their manufacturing operations with Worthington air conditioning and refrigeration.

And many of the famous shops where the mills' products are sold . . . Saks Fifth Avenue, The Higbee Company, J. L. Brandeis, Lane Bryant, many Sears Roebuck Stores . . . are air-conditioned by Worthington.

No other manufacturer makes so complete a line. A Worthington system is all Worthington-*made*—not just Worthington-assembled—assuring you of perfectly balanced operation and unit responsibility.

Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, New Jersey.

America's Leaders... in Many Businesses... Select

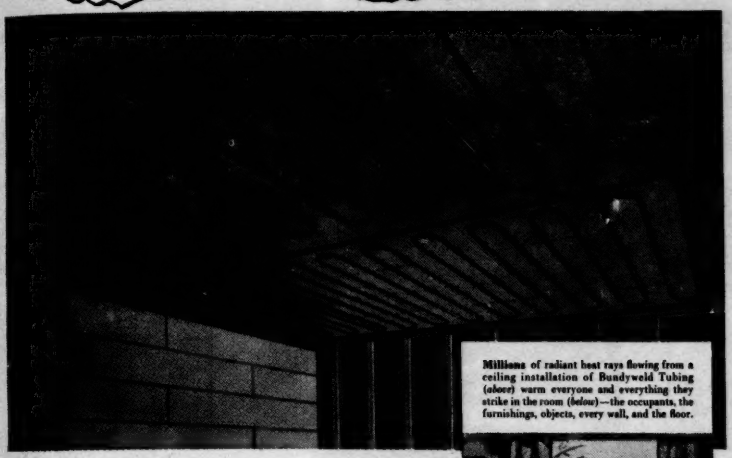
## WORTHINGTON

A-2.9

AIR CONDITIONING AND REFRIGERATION

**The Most Complete Line... Always the Correct Recommendation**

# "Choose ceiling radiant heating," says Bundy to future home owners—for you



Millions of radiant heat rays flowing from a ceiling installation of Bundyweld Tubing (above) warm everyone and everything they strike in the room (below)—the occupants, the furnishings, objects, every wall, and the floor.

## Like having the sun in your ceiling—Bundyweld ceiling radiant heating

**Have you** considered the many advantages of ceiling radiant heating for that home you are planning to buy, remodel, or build? This truly modern system offers you savings, conveniences, and comfort not matched by any other.

With *ceiling* installations of Bundyweld, for example, heat rays flow evenly, freely *downward*, not up through floors to be lost in rugs, furniture, draperies. Here is heating that really *radiates*, gently warming everyone and everything in the room. Heating so comfortable, so natural it's like having the sun in your ceiling.

**Savings, too**

More, because it's draft-free heat, less dust is carried onto upholstery, curtains, draperies. Because it's even heat, no dirt streaks form on walls or ceilings. You save extensively on dry-cleaning, wall-washing, and redecorating costs, enjoy easier day-to-day housekeeping.

These home maintenance economies, plus fuel savings over the first few years, more than pay for any additional first costs. Continuing yearly savings make this your most economical long-run heating system by far.

Talk to your real estate man, heating contractor, architect, or builder about radiant heating now. And about Bundyweld Tubing, too. Bundyweld is the *only* tubing double-walled from a single strip. It's tough steel tubing, copper-coated inside and out. Bundyweld is leakproof, takes high pressures in stride, transmits heat quickly.

*Send coupon for free booklet*

Send coupon at right for free booklet describing fully the many advantages of ceiling radiant heating. Radiant Heating Division, Bundy Tubing Company, Detroit 14, Michigan.

No radiators or registers to interfere with furniture arrangements or take up valuable floor and wall space.

Bundyweld is the only tubing double-walled from a single strip. It's quickly, easily fabricated into completed radiant heating grids—with major savings in time and construction costs

**BUNDY TUBING COMPANY**

Detroit 14, Michigan

WORLD'S LARGEST PRODUCER OF SMALL-DIAMETER TUBING

Radiant Heating Division
Bundy Tubing Company, Detroit 14, Michigan
Send me the free literature I've checked:
☐ Bundy consumer brochure on ceiling radiant heating
☐ Bundy technical brochure for the trade
Name_____
Company_____
Address_____
City_____ Zone_____ State_____

*First ad in new national campaign directed to future home owners.*

**It is the** conviction of Bundy Tubing Company that radiant heating systems rightly belong in *ceilings*.

Bundy tells future home owners *why* in an intensive, full-page, four-color campaign appearing in *Better Homes and Gardens* and *American Home*—magazines carrying immense weight with consumers interested in buying, building, or remodeling homes.

### Are you ready?

Interest in radiant heating has spurted sharply upward since the end of World War II. The all-new Bundy campaign is designed to give future home owners important information on *ceiling* radiant heating and on the Bundyweld Tubing features that help assure a perfect, long-lasting, economical system.

This campaign, of course, will help pave the way to even stronger consumer acceptance of ceiling radiant heating and Bundyweld Tubing. Result for architects and builders: Those who offer Bundyweld ceiling radiant heating systems will have a powerful, convincing, and much-wanted sales feature to speed sales to receptive buyers. Result for plumbing and heating contractors: Continually increasing business and good, sound profits from the installation of Bundyweld ceiling radiant heating systems.

***Radiant Heating Division***

**BUNDY TUBING COMPANY**

***Detroit 14, Michigan***

## Advantages of Bundyweld Tubing

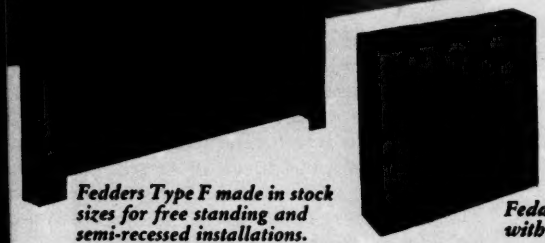
Bundyweld is the only tubing double-walled from a single strip. It's steel, copper brazed through 360° of wall contact, copper-coated inside and out. It gives perfect radiant heating performance. Bundyweld transmits heat quickly. It's leakproof. Its smoothness and freedom from scale promote unimpeded water flow.

Bundyweld gives major fabrication savings, too. Bundyweld comes in 20' lengths for easy handling, one end expanded (when specified) for easy joining. Ductile Bundyweld bends easily on simple fixture. Lightweight, rigid grids of Bundyweld are easily, quickly mounted on ceiling.

**The Bundy consumer brochure on ceiling radiant heating, to be offered in every national radiant heating ad, was written with you in mind, too. Let us send you a copy. It's packed with meaty facts.**

Radiant Heating Division
Bundy Tubing Company, Detroit 14, Michigan
Send me the free literature I've checked:
☐ Bundy consumer brochure on ceiling radiant heating
☐ Bundy technical brochure for the trade
Name_____
Company_____
Address_____
City_____ Zone_____ State_____

# fedders OFFERS AMERICA'



*Fedders Type F made in stock sizes for free standing and semi-recessed installations. Also Type FO.*

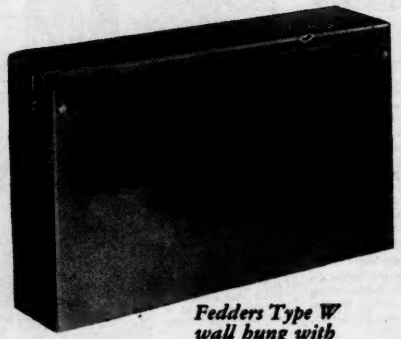


*Fedders Type FB with base grille.*

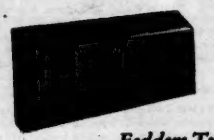
*Fedders Type SF free standing with sloping top.*

*Fedders Type SFB free standing with sloping top and base grille.*

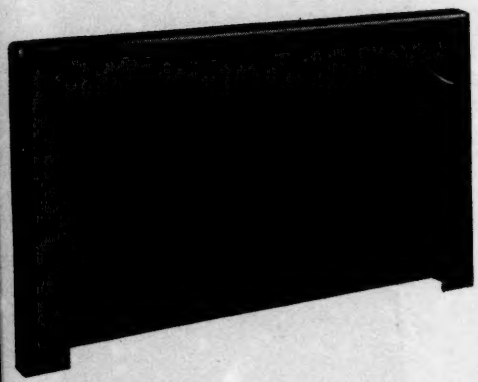
*Fedders Type FE in sizes for special applications.*



*Fedders Type W wall hung with flat top.*



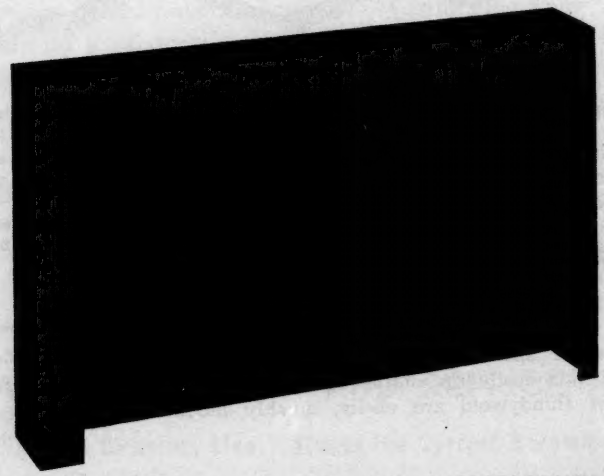
*Fedders Type S wall hung with sloping top.*



*Fedders Type R semi-recessed with overlap front.*

Cutaway view showing location of Fedders finned heating element in Convector cabinet. Note convenient arrangement for piping connections. Edges of cabinet are rounded for handsome styling.

*Fedders Type RB semi-recessed with overlap front and base grille.*



# QUALITY LINE OF

FEDDERS-QUIGAN CORPORATION, 57 TONAWANDA STREET, BUFFALO 7, N. Y.

# "You may have to stand outside!"

REMEMBER Aesop's fable of the camel and his master--how the kind master allowed the shivering beast to put into the tent first his head, next his shoulders, then his forelegs!

And then the camel said, "Master, I think I ought to come wholly inside," and crowded in. Immediately he said, "There is hardly room for us both, so I think it would be better for you to stand outside so I can turn around and lie down." And without further ado, the camel kicked the man out and took the entire tent.

Men have heard this story for 2,500 years--repeatedly have seen how it illustrates what happens when one man or group of men gain power over others. Men saw it happen in Italy and Germany when Mussolini and Hitler took over. Men saw it happen in Russia.

Even here in America a similar trend is evident. Powerful influences overlook no opportunity, through political manipulation, central controls and bureaucratic regulations, to intrude more and more in our private lives. The situation demands continual, alert watchfulness by all citizens who believe in individual liberty and freedom, to prevent this camel of big government from creeping further into the tent. Before we realize it, "we, the people," the master, may find ourselves "standing outside." In America it is government, which is the servant of the people.

YOUR SCRAP IS NEEDED — YOUNGSTOWN

## The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio

Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

# your best ... ALCO AMMONIA CONTROLS!

With ALCO Ammonia Controls "across the board", you'll have a sure checkmate on excessive operating and maintenance costs. ALCO Controls are ruggedly built for dependable service and long, productive life. They keep your refrigeration system at peak efficiency, producing maximum ice at minimum cost.

Write for our Ammonia Bulletin #172 and SEE YOUR ALCO WHOLESALER

1. **TYPE HK** high pressure float valve. Capacity: 2 to 20 tons Ammonia.
2. **TYPE J5** electric float switch for control of solenoid valves, pumps, high-low level alarms. Up to 460 volts AC and 250 volts DC.
3. **TYPE EPR** for evaporator pressure control. Connection sizes ¾" to 6".
4. **TYPE TX** multi-outlet thermo valve. Capacity: 3 to 15 tons Ammonia.
5. **TYPE K & E** automatic expansion valve. Capacity: 1 to 64 tons Ammonia.
6. **TYPE UGZ** thermo expansion valve. Capacity: 1 to 20 tons Ammonia.
7. **TYPE M91F** solenoid valve. Capacity: 10 tons Ammonia.
8. **TYPE FR** thermo expansion valve. Capacity: 26 to 125 tons Ammonia.

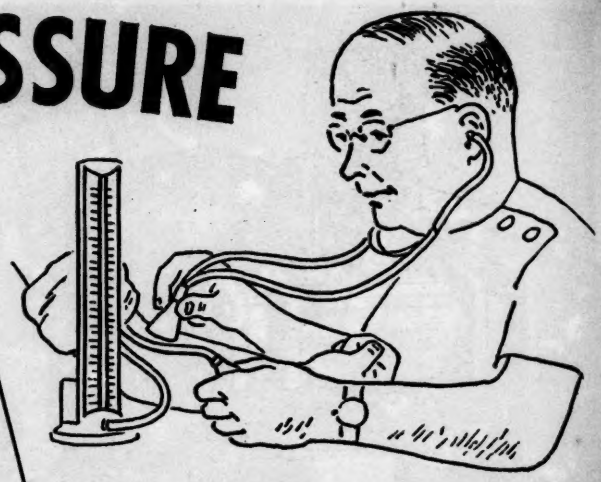
**ALCO VALVE CO.**

859 KINGSLAND AVE. • ST. LOUIS 5, MO.

5016

Designers and Manufacturers of Thermostatic Expansion Valves; Pressure Regulating Valves; Solenoid Valves; Float Valves; Float Switches.

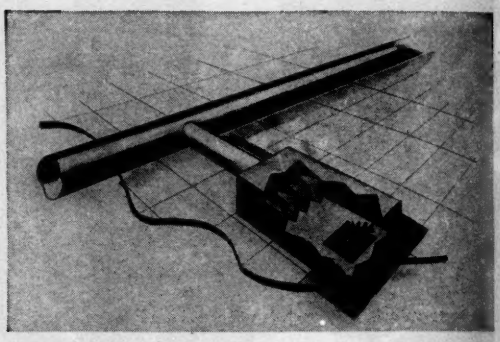
# FOR HIGH PRESSURE PROBLEMS...



Rx CONSULT YOUR

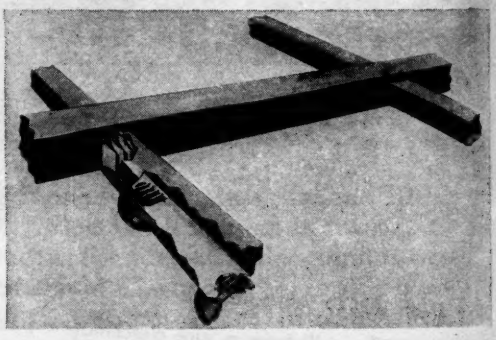
**Uni-Flo®**

DOCTOR... BARBER COLMAN



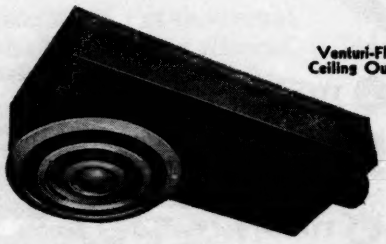
Application of Uni-Flo square outlet to high velocity system. Cutaway view of sound trap reveals a *Deflectrol*, velocity-to-static converter, and a pressure-reducing valve.

For your high velocity installation ask for the specialized services of Uni-Flo factory engineers and their extensive laboratory facilities. Barber-Colman Company has developed devices, for reduction of velocity and pressure, which can be used on systems under static pressures of any practical magnitude.

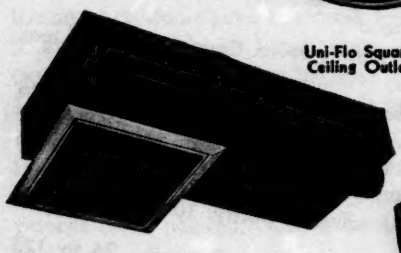


High velocity system using Barber-Colman Venturi-Flo outlets. A pressure-reducing valve is used to supply air to branch ducts at conventional velocities and pressures from a high pressure main duct.

See your Barber-Colman Company local representative. He will submit your particular high pressure problems to Barber-Colman factory engineers for specific recommendations.



Venturi-Flo* Ceiling Outlet



Uni-Flo Square Ceiling Outlet

Uni-Flo Sidewall Grille

For many applications the Uni-Flo pressure-reducing valve may be used in the space directly behind a Barber-Colman Uni-Flo grille.

***Write*** for new illustrated high pressure Bulletin F-4960.

**TYPICAL UNI-FLO HIGH PRESSURE SYSTEMS**

* Reg. U. S. Pat. Off.

BARBER-COLMAN COMPANY • 1224 Rock Street, Rockford, Illinois

# Where Heating Boilers are designed to Power Boiler Standards

*Combustion Engineering Building, New York, with inset showing one of five drafting rooms.*

It pays to build high standards of design and construction into heating boiler installations . . . pays in terms of better performance, greater reliability and lower maintenance and operating expense. And with today's high fuel and operating costs, these performance features are more important than ever before.

Because C-E boiler designers are accustomed to meeting the high standards required for large power boilers, they naturally build into the extensive line of C-E heating boilers, features that make for exceptionally efficient and reliable performance.

Thus you can expect something more for your money in a Combustion-built boiler irrespective of its type or size. Thus you can expect something more for your money in a Combustion-built boiler irrespective of its type or size. You can choose from the well-known VU line of boilers, equipped for any method of firing, in steam capacities ranging up to 60,000 lb per hr. or more; or the C-E Re-circulation Steam Generator—a compact, fully-automatic, packaged steam plant—available in capacities from about 2500 to 6000 lb of steam per hour.

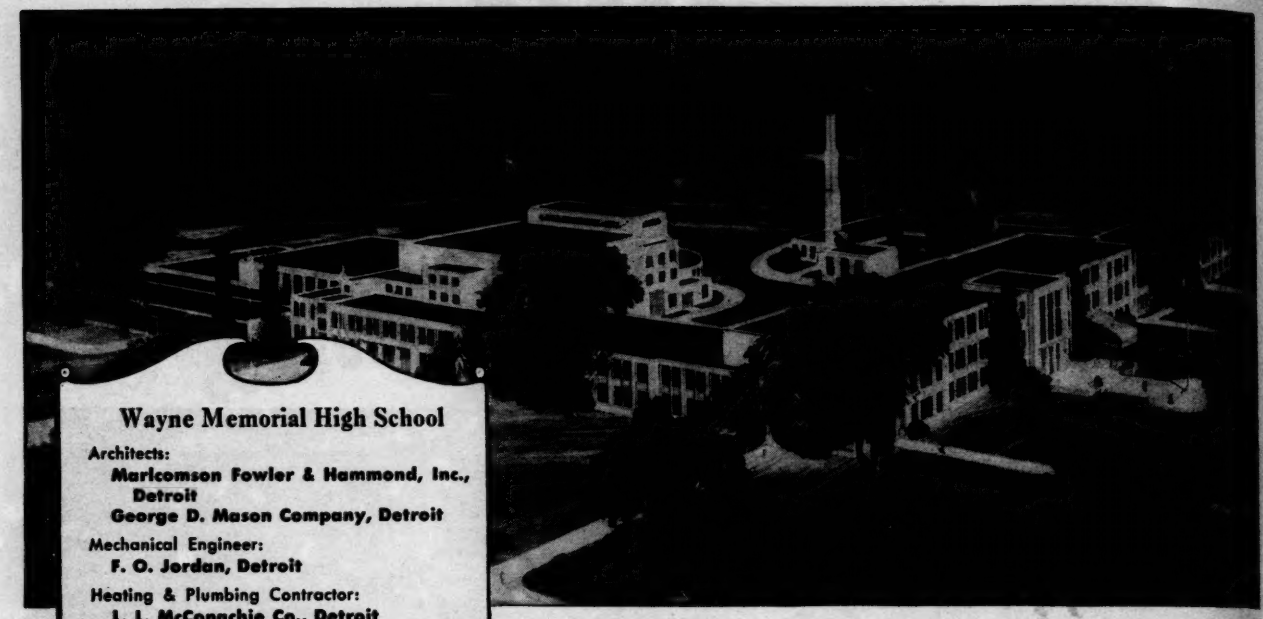
Regardless of your boiler requirements, you can turn with confidence to Combustion, for its knowledge, experience and manufacturing facilities are unsurpassed in the steam generation field. We invite your inquiries and will be glad to discuss your plans at your convenience.

B-565

**Combustion Engineering—Superheater, Inc.**

200 Madison Avenue • New York 16, N. Y.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



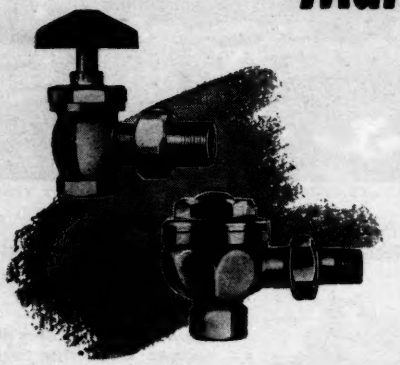
**Wayne Memorial High School**

Architects:
**Marlcomson Fowler & Hammond, Inc., Detroit**
**George D. Mason Company, Detroit**

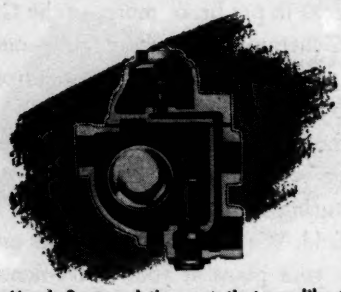
Mechanical Engineer:
**F. O. Jordan, Detroit**

Heating & Plumbing Contractor:
**L. L. McConachie Co., Detroit**

# Marsh Valves and Traps Throughout



Marsh Packless Valves and Radiator Traps were chosen throughout for the Wayne Memorial High School. The most permanent packless valve construction is the Marsh metal-to-metal seal and the best team-mate for this better valve is the Marsh radiator trap.



Marsh float and thermostatic traps like this were used in the Wayne High School.

Pride of its community is this modern 3½ million dollar high school at Wayne, Michigan, near Detroit. It is a worthy addition to the growing list of model school buildings that are rising to the call of the tremendously increased number of young folks who are going in for more and more education.

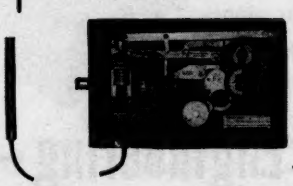
Such buildings are planned and erected to become a lasting part of community activities; so it is significant that a large number of Marsh valves and traps were used in the well-engineered system which heats the laboratories, library, cafeteria, gymnasium, offices and classrooms.

But high tribute though it is, the selection of Marsh equipment here is simply one more example of the preference accorded Marsh heating specialties by foremost heating engineers and contractors in every section of America.

For your next job consider the equipment that is first choice of the most critical heating men. Write for the Marsh heating specialties catalog, 76-H, covering Marsh valves, traps, venting devices and the dollar-saving Marsh Tri-Trol regulator.

**MARSH HEATING EQUIPMENT CO.**
*Sales affiliate of Jas. P. Marsh Corporation*
**Dept. U, Skokie, Ill.**

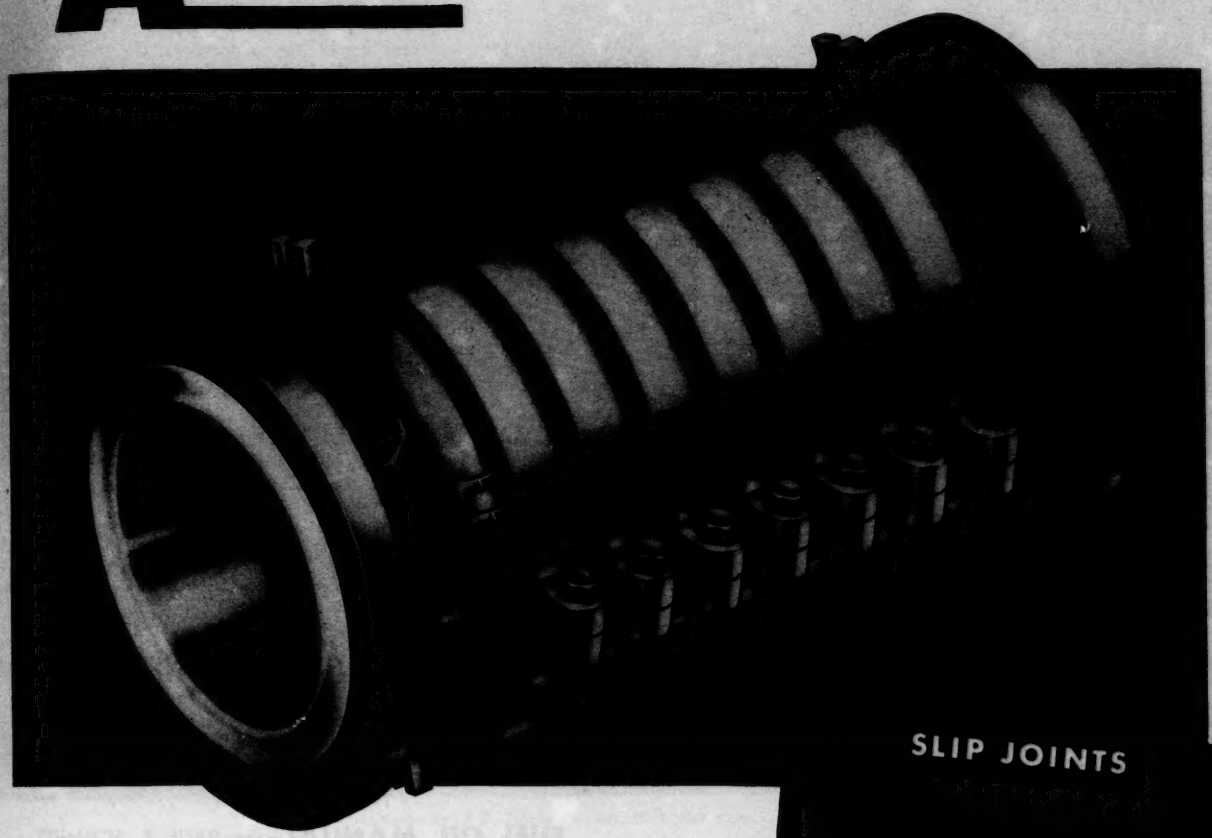
**BIG FUEL SAVING WHEN HEAT REGULATION IS IN STEP WITH THE WEATHER:—**



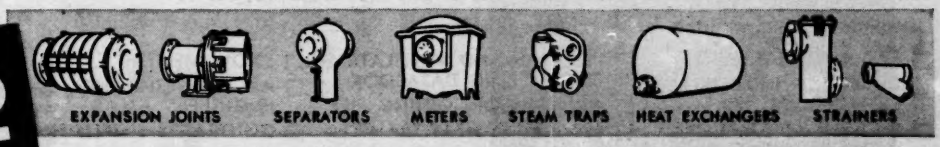
Marsh Tri-Trol is the simple, low-cost, easily installed heat regulator for multiple occupancy buildings from smallest to largest. Ask for bulletin showing how it gives ideal heating comfort at lowest cost by controlling heating in accordance with outside temperature.

**MARSH** *Heating Specialties* **SINCE 1865**

# ADSCO EXPANSION JOINTS



We don't have to sell what you don't want to buy, because only ADSCO makes a complete line of expansion joints. The modern Corruflex, shown above, is the result of 50 years' experience in packless expansion joints. Equalizing and non-equalizing Corruflex joints cover wide temperature and pressure ranges and are built in many designs, including universal, tie-rod, hinge, and fully-guided. They will solve nearly all pipe-expansion problems caused by temperature differential, whether the material in the pipes is liquid, gas, or steam. Write for Bulletin 35-51.




ADSCO
75 YEARS OF LEADERSHIP

**AMERICAN DISTRICT STEAM COMPANY, INC.**
**NORTH TONAWANDA, NEW YORK**

# Authoritative, Useful, Practical TECHNICAL BOOKS

*Written by outstanding authorities, and published by HEATING AND VENTILATING, these books give Engineers, Contractors, Students and Architects clear, concise answers to many heating, ventilating and air conditioning problems. Use the convenient coupon below to order these books direct from the publisher.*

## METHODS OF JOINING PIPE
**—by J. E. YORK**

In no other book will you find so much detailed information on standard and special joints for all types of metallic, glass, tile, plastic and concrete pipe. Also included are data on joints designed to take up movement due to expansion and contraction. Written by a mechanical engineer with many years' experience.

*236 pages, 249 illustrations, $3.00. Canadian or foreign postage, 40¢*

## RADIANT HEATING — 2nd Edition
**—by T. NAPIER ADLAM**

The basic principles, the experience-proved facts, the practical working data on applications of radiant energy for heating and cooling. Facts and figures can be applied directly in designing and installing radiant heating systems. A dependable manual for the engineer, contractor or architect who needs reliable information on this important subject.

*504 pages, 337 illustrations, $6.00. Canadian or foreign postage, 50¢*

## HEATING AND VENTILATING'S ENGINEERING DATABOOK
**—by CLIFFORD STROCK**

Essential working data and practical information on heating, piping, air conditioning, ventilation, air sanitation and refrigeration for design, installation and operating engineers. Time-saving tables and large scale charts greatly simplify everyday estimating and design problems.

*576 pages, 8½" x 11", $7.00. Canadian or foreign postage, 80¢*

## AIR CONDITIONING ENGINEERS' ATLAS
**—by CLIFFORD STROCK**

Climatic data for the solution of design and operating problems in winter heating and summer cooling throughout the United States. Zoned maps in colors and tables with data for larger cities.

*72 pages, 18 maps in color, $2.00.*

## SNOW MELTING—by T. NAPIER ADLAM

A valuable handbook of correct, *tested* practice that covers the steps in planning, designing, building and operating snow melting systems of all sizes and types. Time-saving charts, tables and graphs give all the necessary data and simplify every step from preliminary planning to final operation.

*224 pages, 189 illustrations, $4.50. Canadian or foreign postage, 40¢*

## FUEL OIL MANUAL—by PAUL F. SCHMIDT

Covers characteristics and uses of every type and grade of fuel oil. Explains the meaning of each oil property, and shows how this information is applied in selecting, handling and burning fuel oil.

*160 pages, 34 tables, $3.50. Canadian or foreign postage, 40¢*

## DESIGN OF INDUSTRIAL EXHAUST SYSTEMS—by JOHN L. ALDEN

How to design, build or buy an exhaust system that will perform its functions adequately and economically, and meet the requirements of law and industrial hygiene. Covers flow of fluids—hood forms—air flow through hoods—pipe resistance—piping design—dust separators—low pressure conveyors—centrifugal exhaust fans—structural details—field measurements and their interpretation.

*252 pages, 122 illustrations, $3.50. Canadian or foreign postage, 35¢*

## INDUSTRIAL HEAT TRANSFER
**—by F. W. HUTCHINSON**

A combined text and reference book that provides time-saving working graphs for the direct solution or most commonly encountered problems.

*336 pages, 136 charts and illustrations, $6.00. Canadian or foreign postage, 50¢*

## CONTRACTS SIMPLIFIED—by LEO T. PARKER

Heating, ventilating and air conditioning cases involving higher court decisions analyzed to clarify the law of contracts, chattel mortgages, and real estate law, the legal status of independent contractors, and patent law.

*26 pages, paper bound, $1.00. Canadian or foreign postage, 6¢*

## ORDER FORM

H&V-3.52

**HEATING AND VENTILATING, 148 Lafayette Street, New York 13, N. Y.**

**Please send me the books checked below:**

- ☐ RADIANT HEATING
- ☐ DESIGN OF INDUSTRIAL EXHAUST SYSTEMS
- ☐ FUEL OIL MANUAL
- ☐ HEATING AND VENTILATING'S ENGINEERING DATABOOK
- ☐ METHODS OF JOINING PIPE
- ☐ INDUSTRIAL HEAT TRANSFER
- ☐ SNOW MELTING
- ☐ AIR CONDITIONING ENGINEERS' ATLAS
- ☐ CONTRACTS SIMPLIFIED

Name .....

Address .....

City ..... Zone ..... State .....

Position* ..... Firm* .....

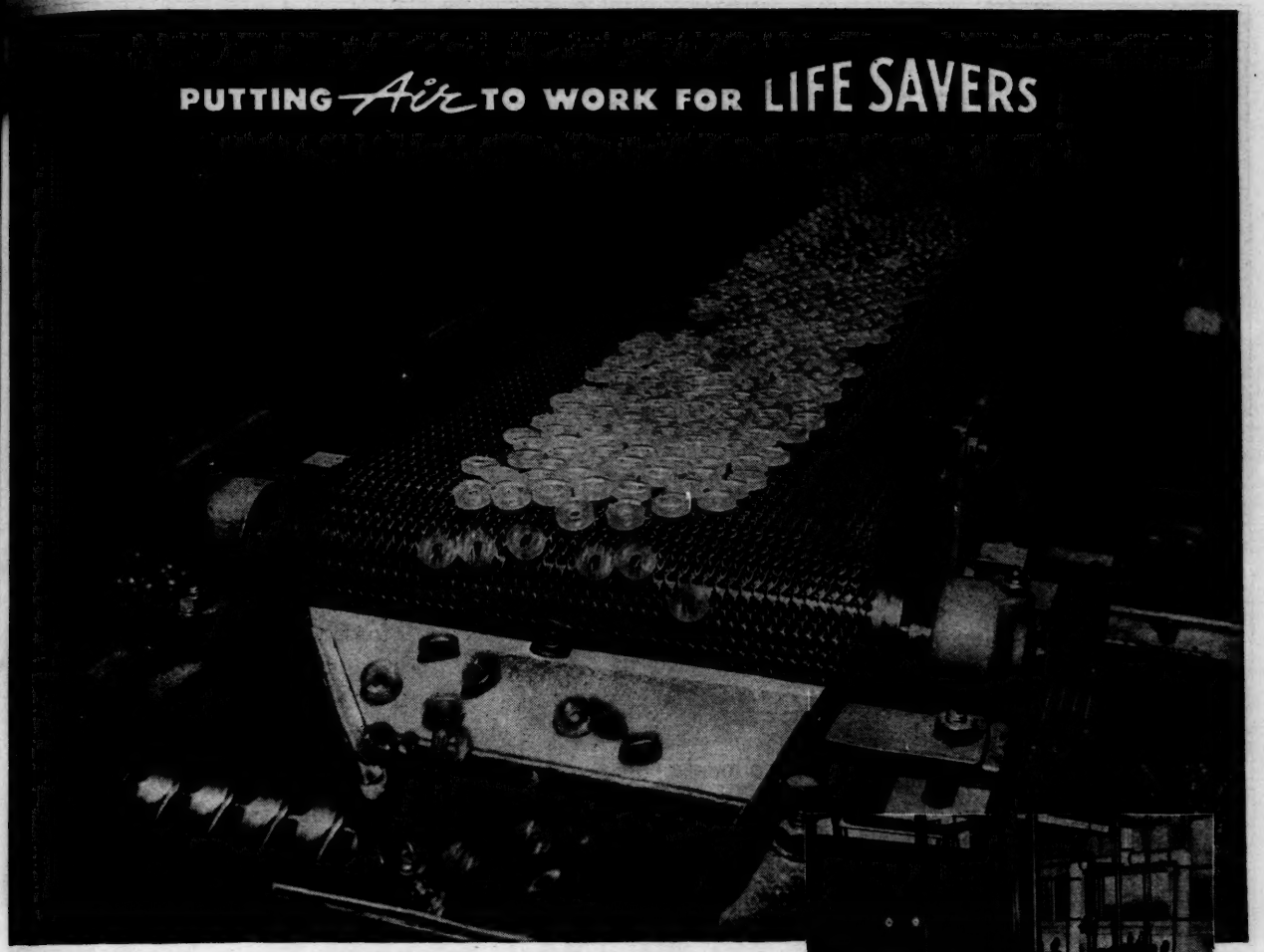
*This information would be appreciated for our records.

**METHOD OF PAYMENT**

☐ I enclose check or money order in full payment.

☐ I enclose 1/3 down payment (if order amounts to $6.00 or more) and will pay balance in monthly installments. ($6.00 to $9.00, two additional installments. $10.00 to $20.00, three additional installments. $21.00 to $30.00, four additional installments.)

PUTTING *Air* TO WORK FOR LIFE SAVERS



*Air Conditioning by: J. P. Salmini Co., Inc., Bridgeport, Conn.*

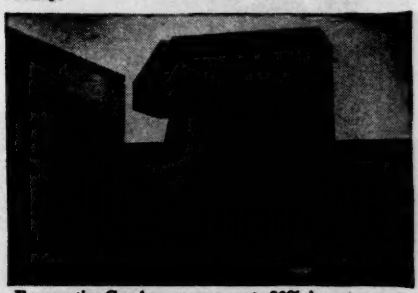
# COOL AIR
## STEPS UP A FLAVOR PARADE

At Life Savers, intricate machines stamp out the familiar "candy with the hole"—3,600 a minute! When formed, the candy drops are soft and pliable. During the critical next few minutes, they must be cooled quickly and evenly.

Westinghouse equipment *puts air to work* for Life Savers by providing chilled air through which the candy drops travel on conveyor belts. In addition, the candy production department is air conditioned. Clean, cool air conditioning by Westinghouse assures the uniform quality for which Life Savers are famous the world over.

There's Westinghouse Air Conditioning equipment specifically designed to make air work *for you* in processing operations . . . whether it's air conditioning, air handling or air cleaning. Call the Westinghouse Air Conditioning Distributor in your classified phone directory, or write Westinghouse Electric Corp., Air Conditioning Division, Hyde Park, Boston 36, Mass.

Westinghouse Compressors are the heart of this cooling system. Hermetically sealed for maximum dependability.



Evaporative Condensers save up to 90% in water consumption. Designed for installation where water is scarce.

Silentvane® fans handle large volumes of air. Specially designed blade wheel delivers non-pulsating air flow.

YOU CAN BE SURE...IF IT'S

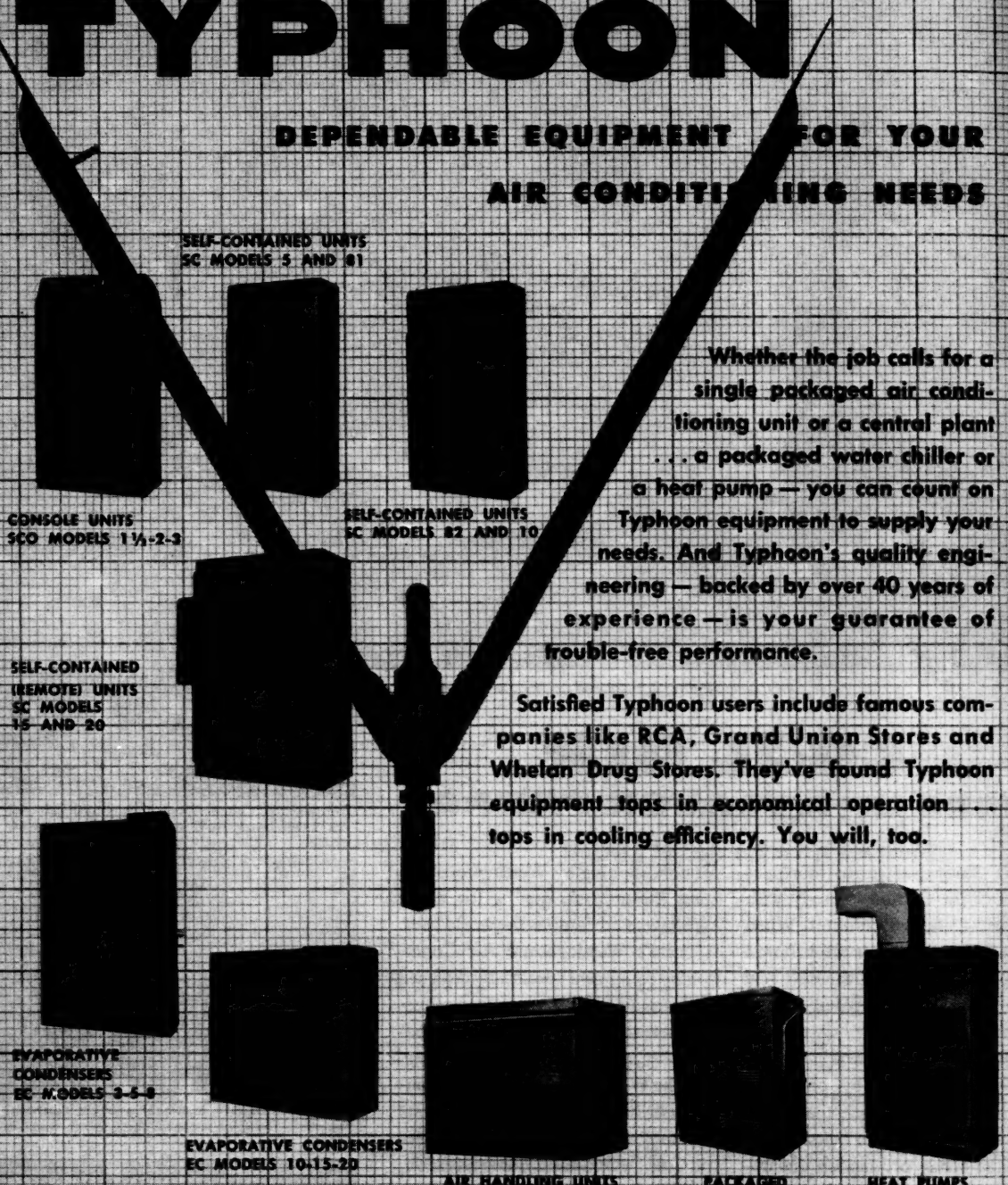
# Westinghouse

J-80219

*Quality-Engineered by*

# TYPHOON

**DEPENDABLE EQUIPMENT FOR YOUR AIR CONDITIONING NEEDS**




Whether the job calls for a single packaged air conditioning unit or a central plant . . . a packaged water chiller or a heat pump — you can count on Typhoon equipment to supply your needs. And Typhoon's quality engineering — backed by over 40 years of experience — is your guarantee of trouble-free performance.

Satisfied Typhoon users include famous companies like RCA, Grand Union Stores and Whelan Drug Stores. They've found Typhoon equipment tops in economical operation . . . tops in cooling efficiency. You will, too.

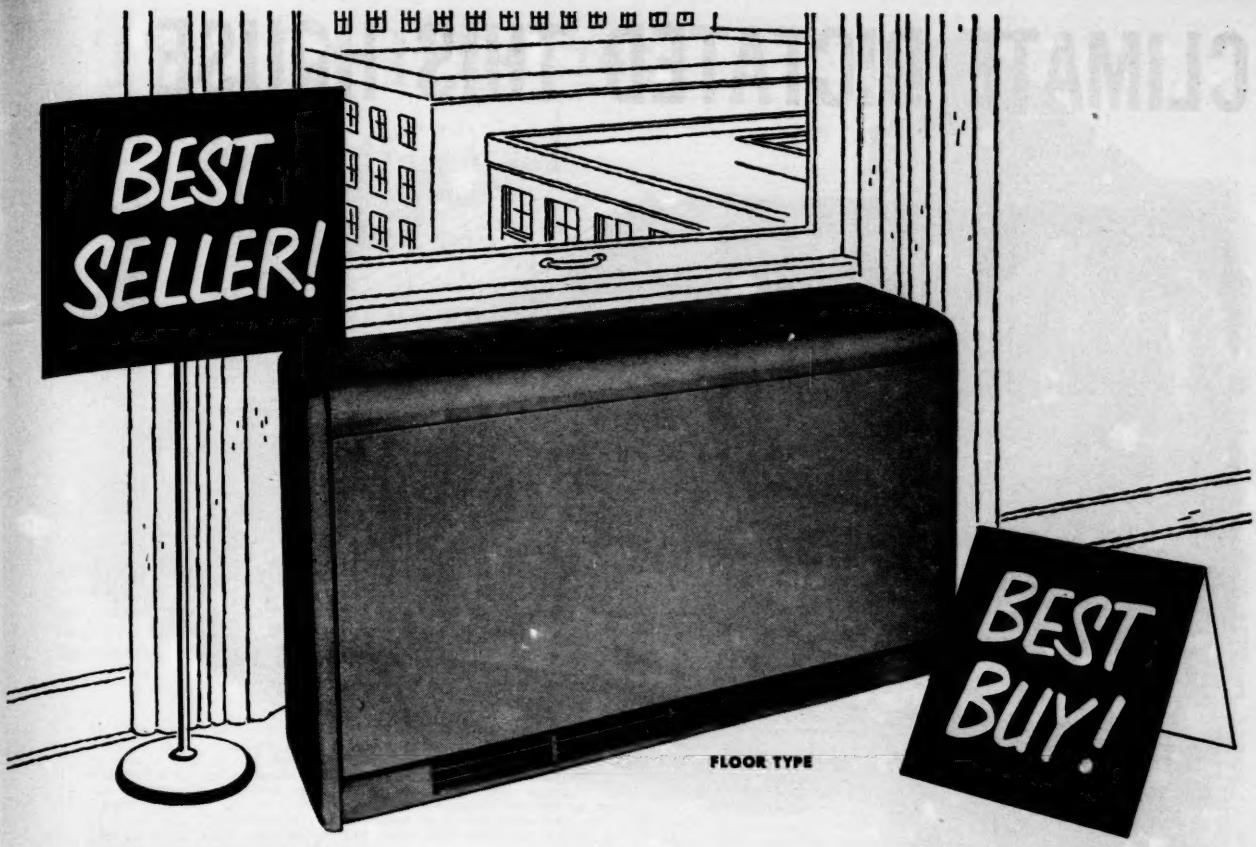
ALSO — WINDOW UNITS, BOILERS, COILS AND MULTI-PACKAGED SYSTEM UP TO 60 TONS.

*Write for Detailed Information*

**TYPHOON AIR CONDITIONING CO., INC.**

794 Union Street, Brooklyn 15, N. Y.

*Specialists in Air Conditioning Since 1909*




FLOOR TYPE

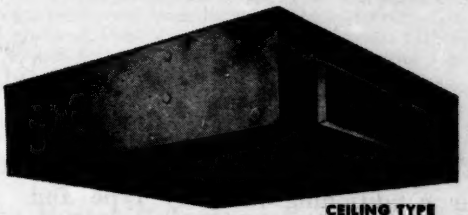
# McQuay SEASONMAKERS

## INDIVIDUAL ROOM AIR CONDITIONERS

*(For use with central chilled water or freon system)*

A best seller for you and the best buy for your customer! McQuay Seasonmakers satisfy the demand for individual room comfort. The Seasonmaker's quiet operation and attractive design are welcome additions to any multi-room building.

The Seasonmaker's year 'round performance actually "make the seasons come to you" ... providing heated, and filtered air in winter; cooled, dehumidified, and filtered air in summer.



CEILING TYPE
for suspended mounting

Famous McQuay Ripple-Fin coil construction assures long life and dependable service. These units are easy to install and maintain. Available in three sizes and types to fit the requirements of old and new buildings. Write for Condensed Bulletin 700 for full details. Representatives in all principal cities.

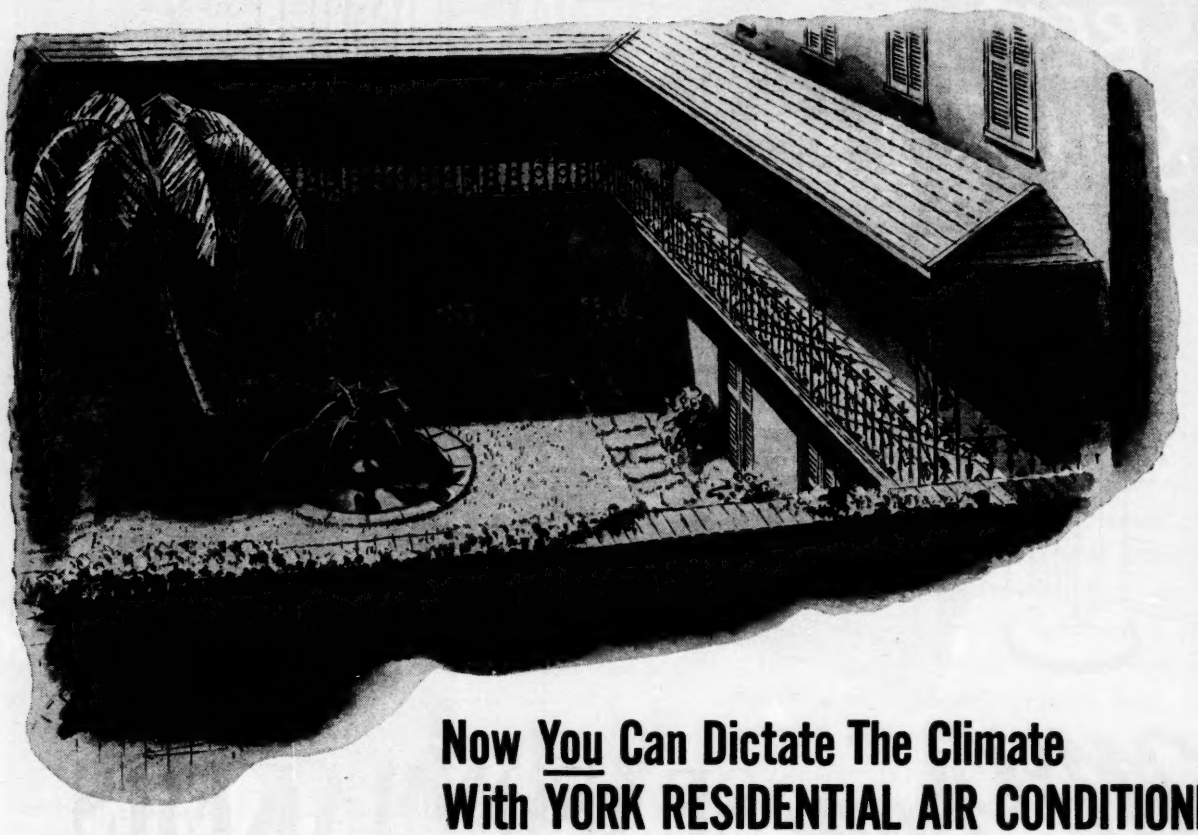
BASIC TYPE
for fully recessed installation

McQuay INC.

1619 BROADWAY STREET N. E., MINNEAPOLIS 13, MINN.

AIR CONDITIONING • REFRIGERATION • HEATING

# CLIMATE DICTATED THIS HOUSE



## Now You Can Dictate The Climate With YORK RESIDENTIAL AIR CONDITIONING

*York Residential Air Conditioning makes it possible for you to ignore the demands of climate in designing and building houses of even modest outlay. Taste alone determines your design.*

York enables you to provide for all-year, trouble-proof residential air conditioning in every type and size of residence—at lowest possible first costs, and lowest possible operating costs.

The York Residential Air Conditioner can be teamed to work efficiently with any forced-warm air heating plant or, with a minimum of ductwork, operated independently. Unusually adaptable, it can be installed easily and economically in cellar, attic, service closet or garage . . . in houses already existing or now under construction.

Let your York Representative save you time and details in your air conditioning planning. Consult him today (he's listed in the Classified Directory) or write York Corporation, York, Pennsylvania.

York

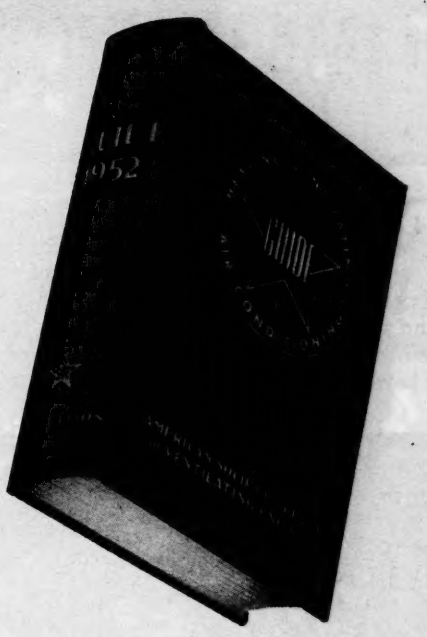
**The big advances come from YORK**

*Headquarters for*— **Refrigeration and Air Conditioning**

# THE GUIDE 1952

## *Ready March 25th*

## *–to give you all the right answers to your problems in Heating, Ventilating, and Air Conditioning*



**USE THIS BOOK as thousands do for ready reference and to help solve heating, ventilating and air conditioning problems. All chapters edited, revised and brought up-to-date by experts in their respective fields. Glance below and see what a wealth of practical data this big, 1496 page book contains.**

### *Special Features of THE GUIDE 1952*

50 chapters on subjects of greatest interest to heating, ventilating and air conditioning engineers. Design tables for solar heat gain through roofs, windows, glass block, and figured rolled glass. Heat loss coefficients, tables, and formulas for computing heating load. A simple method for designing panel heating systems. Characteristics of present-day solid, liquid, and gas fuels; rules for their effective use, and equations and charts for determining combustion losses. Recommendations for prevention of moisture and condensation damage in building construction. Air conditions required for a large number of industrial processes. The ASHVE Psychrometric Chart (24 x 32 in. in 2 colors) with instructions for use in solving air conditioning problems. Most reliable tables on properties of moist air. Performance and selection data for large and small chimneys. Recommendations for gas appliance vents and chimneys. List showing latest editions of 140 codes and standards affecting testing, rating, selection, and installation of equipment used in heating, ventilating, and air conditioning.

## *There is nothing comparable to THE GUIDE!*

Nowhere else can you find such a wealth of technical data so necessary and important to heating and ventilating engineers, contractors, architects, dealers, and students. Many revisions and improvements make this new 1952 Edition an indispensable tool. In addition to the Technical Section it contains an Index to Modern Equipment used in this field, plus a Catalog Data Section featuring new time and money saving equipment and materials extremely useful when writing specifications and making plans. THE GUIDE has the unique distinction of having all this valuable information between two covers, immediately available, authoritative, condensed and practical. Don't guess—be certain—consult THE GUIDE. Use the coupon below to make sure of receiving **your** copy promptly.

## TYPICAL SECTIONS

AIR CONDITIONING SYSTEMS: Equipment arrangement, and operation for year 'round air conditioning explained simply. Cost of owning and operating outlined. AIR CONTAMINANTS: Nature and control of contaminants in air discussed, and limits indicated. AIR DISTRIBUTION: Standards and methods for proper air distribution given. Formulas and charts included to aid in selection of outlets. AIR DUCT DESIGN: Includes ASHVE Air Friction Charts, together with basic formulas and tables for rectangular equivalents of round ducts and friction loss in elbows. Practical design for duct system illustrated. CHIMNEYS: Theory and actual operation of large and small chimneys considered. Formulas and charts for selecting residential chimney sizes included. CODES: Latest editions and sources of 140 codes and standards compiled for ready reference. COOLING LOAD: Weather design data for 316 localities listed. Solar heat gain tables included for glass, glass block, and figured rolled glass from ASHVE research. Simpified method shown for computing heat gain through walls and roofs. Steady state and periodic heat flow discussed. DRYING SYSTEMS: Theory and methods of drying outlined. Typical drying equipment illustrated. FLUID FLOW: Basic theory of fluid flow through pipes, nozzles, and orifices presented clearly and concisely. FUELS, COMBUSTION, AND EQUIPMENT: Gives properties of present-day fuels and their combustion data. Adjustment and operation of fuel-burning equipment explained. HEAT LOSS CALCULATIONS: Includes basic formulas and extensive tables for determining building heat loss for typical construction. Weather design conditions given for U. S. and Canadian cities. HEAT TRANSFER: Basic formulas applying to heat transfer by conduction, convection, and radiation are developed. Unit conductances for thermal convection for various surfaces are tabulated. Net radiation solutions for various relative positions of surfaces are given. HEATING SYSTEMS: Various types of steam, hot water, panel, warm air, and all-year comfort systems described. Data for determination of pipe and duct sizes. INSTRUMENTS: Outlines methods of measurement and instruments used in heating, ventilating and air conditioning. PANEL HEATING: A simple method for design of panel heating systems. PHYSIOLOGICAL REACTIONS: Basic data and standards for comfort, explains reaction of human beings to atmospheric environment outside comfort range. Includes ASHVE Comfort Chart. Shows value of air conditioning in prevention and treatment of disease. REFRIGERATION: Simple presentation of different refrigeration cycles, types and functions of equipment, and controls. Outlines factors affecting use of the heat pump. THERMODYNAMICS: Simple discussion of thermodynamics in air conditioning, with illustrative problems showing use of ASHVE Psychrometric Chart and tables of properties of air from −160 F to +200 F. WARM AIR SYSTEMS: Design of gravity and forced circulation systems, simplified by use of tables. Perimeter and ceiling panel systems described. WATER SERVICES: Shows how to determine service water demand, pipe sizes for cold and hot water systems, for cooling towers and for refrigeration. Gives data for selection of heater and storage tank capacity.

### *The Master Reference Book of the Industry*

### PRICE $7.50

### CLIP AND MAIL TODAY

**THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS**

**62 Worth St., New York 13, N. Y.**

**Enclosed is $7.50 for standard edition of Heating Ventilating Air Conditioning Guide 1952; please send me a copy. It is understood that I may return it within 10 days, if it is not satisfactory, and you will refund my money.**

**Name** _____

**Firm** _____

**Address** _____

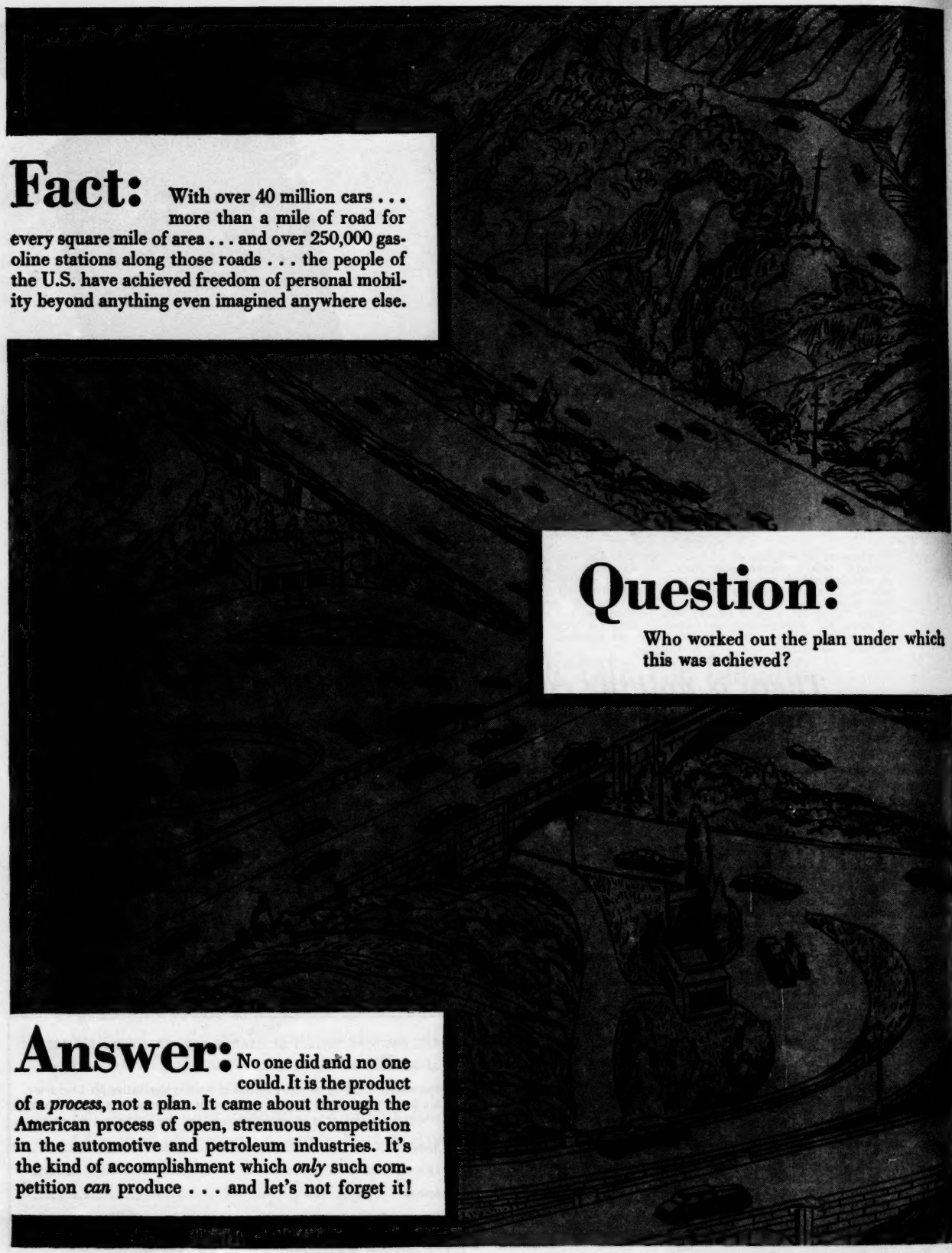
**City and State** _____

**(PLEASE CHECK ONE)**

☐ CONSULTING ENGINEER ☐ OPERATING
☐ MANUFACTURING EXECUTIVE ☐ UTILITY
☐ CONTRACTOR ☐ GOVERNMENT DEPARTMENTS
☐ INDUSTRIAL ☐ _____

**(State Other Classifications)**

**Canada and Foreign Countries Please Remit in U. S. Dollars**
**Remittance Required With Order. Enclose ☐ Check or ☐ Money Order**
**HV No C.O.D. orders accepted.**



**Fact:** With over 40 million cars . . . more than a mile of road for every square mile of area . . . and over 250,000 gasoline stations along those roads . . . the people of the U.S. have achieved freedom of personal mobility beyond anything even imagined anywhere else.

**Question:**

Who worked out the plan under which this was achieved?

**Answer:** No one did and no one could. It is the product of a *process*, not a plan. It came about through the American process of open, strenuous competition in the automotive and petroleum industries. It's the kind of accomplishment which *only* such competition *can* produce . . . and let's not forget it!

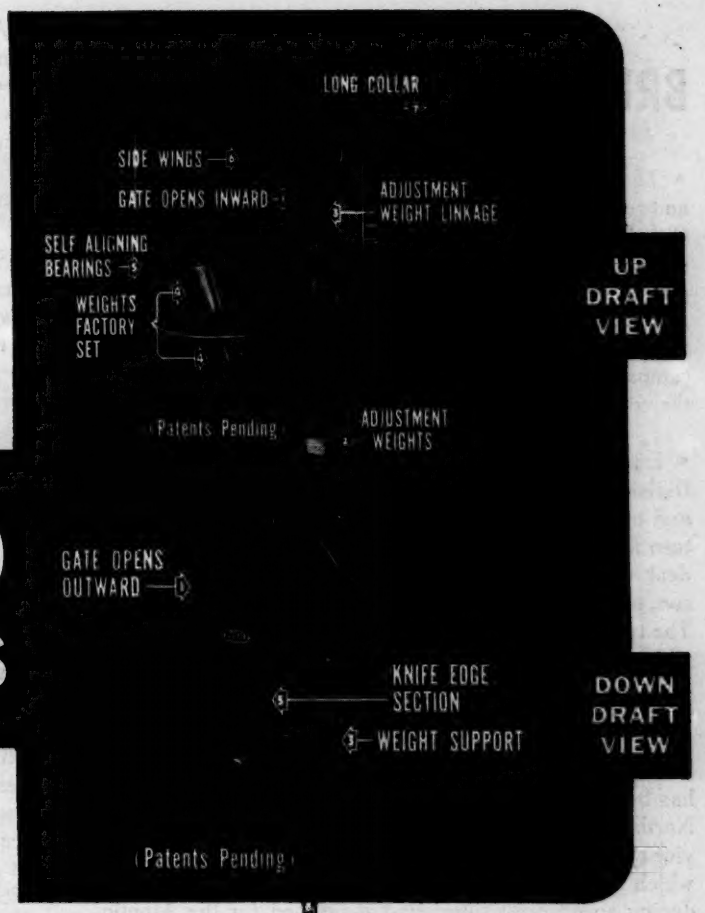
*This report on PROGRESS-FOR-PEOPLE is published by this magazine in cooperation with National Business Publications, Inc., as a public service. This material, including illustration, may be used, with or without credit, in plant city advertisements, employee publications, house organs, speeches or in any other manner.*

**The competitive system delivers the most to the greatest number of people**

# *Now* ... a *field* BAROMETRIC DRAFT CONTROL FOR COMMERCIAL & INDUSTRIAL

# GAS FIRED HEATING PLANTS

## (Not yet available in domestic sizes)




**The Field "M-G" Double Acting Draft Control brings greater efficiency, greater economy to gas fired heating plants through extremely accurate control of drafts. The double-acting gate opens inward to regulate up-drafts, and outward to relieve internal or down-draft pressures as small as a few thousands of an inch. This newest Field Draft Control provides for gas-fired heating plants the same accuracy, sensitivity and dependability that have made Field Draft Controls first in the coal and oil-fired fields. Write today for detailed specifications.**

## FIELD CONTROL DIVISION

of H. D. Conkey & Company, MENDOTA, ILLINOIS

**SEE OUR DISPLAY BOOTH 152, OIL HEAT INSTITUTE CONVENTION, PHILADELPHIA.**

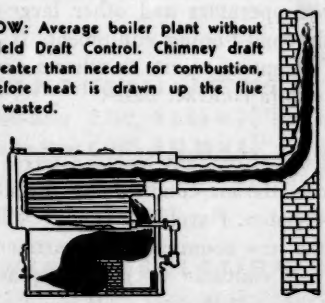
**In case of prolonged down draft or blocked flue, an optional auxiliary switch can be mounted on the control and wired to shut off the burner, thus providing protection against the escape of carbon monoxide into the building.**

**RIGHT: Chart shows draft variations typical of most plants before Field Control is installed.**

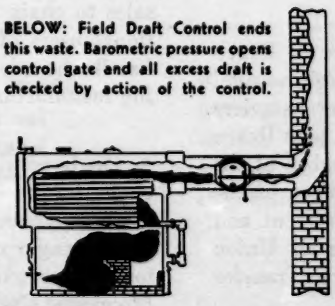
**LEFT: After Field Control installation the breeching draft is held constant.**

## Why a Field Draft Control:

**BELOW: Average boiler plant without a Field Draft Control. Chimney draft is greater than needed for combustion, therefore heat is drawn up the flue and wasted.**



**BELOW: Field Draft Control ends this waste. Barometric pressure opens control gate and all excess draft is checked by action of the control.**



CONTROLLED DRAFT BY *field* BAROMETRIC CONTROLS

# BRIEFLY STATED

• The C. E. Squires Co. has recently acquired the assets and equipment of The Mouat Vapor Heating Co. of Cleveland. In the future Mouat heating specialties, consisting of radiator traps, air vents, boiler cleaner compound, etc., will be manufactured by C. E. Squires and merchandised through their network of manufacturers' representatives. At the present time they are conducting a campaign to sign up stocking distributors throughout the country.

• Establishment by Cambridge Corp. of a Mechanical Division for the handling of a large scale development and manufacturing program in the extreme low temperature field, has been announced by Cloud Wampler, president of Carrier Corp., Syracuse, N. Y., and Earl P. Stevenson, president of Arthur D. Little, Inc., Cambridge, Mass. The two companies are joint owners of Cambridge Corp. which was formed last year. Manufacturing facilities and headquarters of the new division are located in Somerville, Mass. Roger S. Warner, Jr., has been designated as vice president and project manager of the Mechanical Divison. Dr. Bruce S. Old, vice president of Arthur D. Little, Inc., has been named president of Cambridge Corp. David H. Northrup, formerly of Carrier Corp., is continuing as vice president in charge of the Cambridge Filter Division, which is headquartered in Syracuse. This division is producing an absolute filter, first developed for the Atomic Energy Commission.

• The Babcock & Wilcox Co. has started construction on a new plant in Paris, Texas. This is the third new plant to be announced by the company within a year. The plant will employ 750 men when it gets into operation this summer and will manufacture components for large utility and industrial boilers. It will also assemble smaller boilers, a new integral unit recently designed by the company. Total area under roof in the new plant will be 135,000 sq ft composed of three bays 500 ft by 90 ft. In addition, there will be 1500 ft of uncovered craneway.

• The appointment of John W. Hanlon as sales manager of the Carry-All Division of Morrison Steel Products, Inc., Buffalo, N. Y., has been announced. This is a return of Mr. Hanlon to Morrison. Before the war he was in charge of sales for the eastern section of the United States for the Carry-All Division. He recently resigned as sales manager of Dermetics, Inc., N. Y.

• Walter P. Berg, vice president and director of Dravo Corp., Pittsburgh, died suddenly in a Pittsburgh hospital on Sunday, February 3, at the age of 60. Funeral services were held Wednesday, February 6. Associated with Dravo Corp. for 30 years, Mr. Berg also was a member of the firm's executive committee and general manager of the Machinery Division. In addition he was president and director of Dravo-Doyle Co., and a director of Union Barge Line Corp., Tri-Lok Co. and Southern Transfer Co., Memphis, Tenn.

• A home heating and cooling department, and a heat pump department has been established in the General Electric Company's Air Conditioning Division. S. J. Levine has been appointed general manager of the new home heating and cooling department, and H. M. Brundage has been named general manager of the new heat pump department.

• Stewart E. Lauer was re-elected president of York Corporation during the annual meeting of the company's board of directors recently. He was first elected president of the air conditioning and refrigeration firm in 1940.

• The RCA-Victor Division of Radio Corporation of America has become a member of the Air Conditioning and Refrigerating Machinery Association. RCA recently announced its entry into the room air conditioner field.

• Mueller Brass Co., Port Huron, Mich., has purchased all outstanding stock of the Valley Metal Products Co. of Plainwell, Mich. The new subsidiary will operate as a division of the parent company although retaining its own trade name of Vampco. The Valley Metal Products Co. is engaged in the manufacture of aluminum windows for residential, institutional and commercial buildings as well as the extrusion of aluminum into special shapes. Present plans call for a continuance of the business as now operated. Tyler Riggin has been named executive vice president of the new division; Donald O. Stiles present general manager, is to remain in that capacity. Other officers of the new subsidiary are identical with those of the Mueller Brass Co.

• The firm name of Chicago Metal Hose Corp. has been changed to Flexonics Corp. as being more representative of the broadening scope of the company. The name Flexonics is a coined word for the science of the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion.

• Wolverine Tube Division of Calumet and Hecla Consolidated Copper Co., Detroit, announces the appointment of George D. Potter, general sales manager, to the position of director of sales. Replacing Mr. Potter as general sales manager is John M. Dumser, who has been serving as assistant to the general sales manager.

• Organization of a new air conditioning contract sales department, with R. M. Anderson as manager, has been announced by Servel, Inc. The new department will handle sales to chain store operators and other large-scale national users of air conditioning equipment. It will also handle the sale of component parts to other air conditioning manufacturers on a contract basis.

• The General Electric Company has transferred its room cooler business from the air conditioning division to the major appliance division. Harold B. Donley will be general manager of the new room cooler department, which for the present will continue to be headquartered at Bloomfield, N. J.

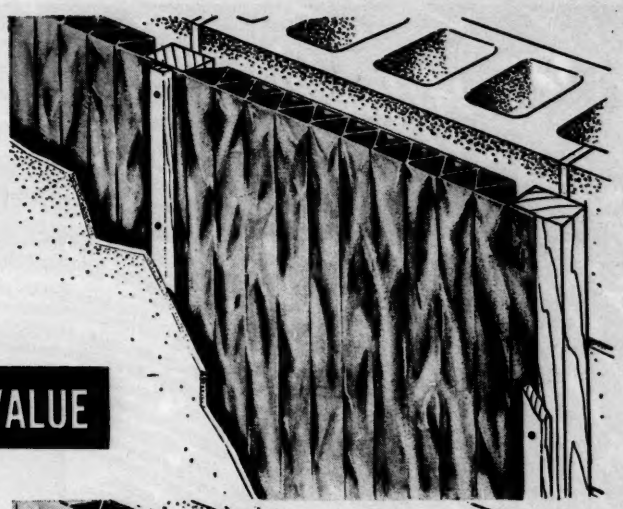
# *How to*

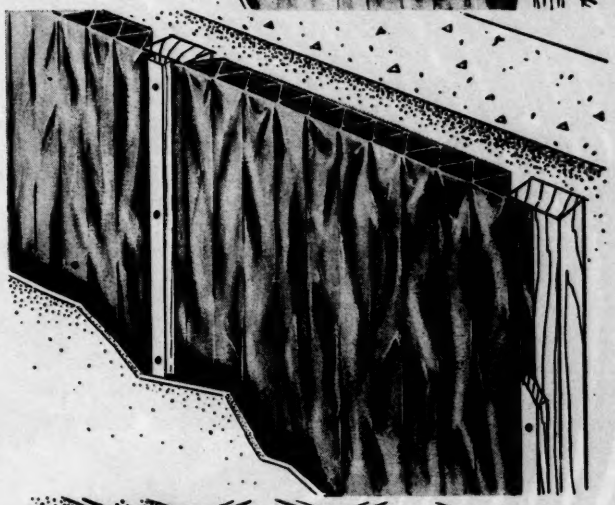
## INSULATE MASONRY WALLS

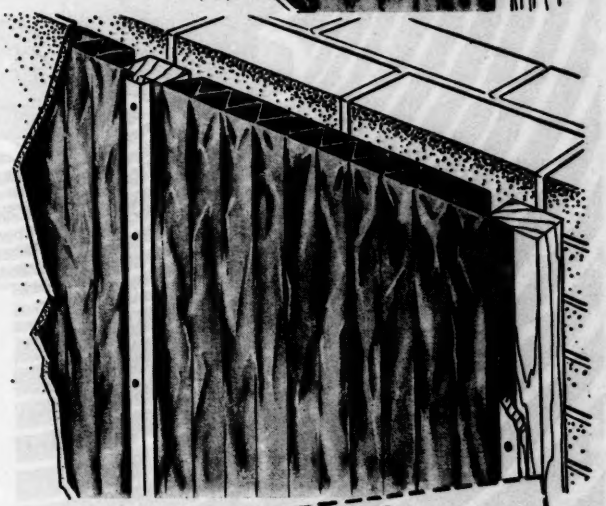
## CREATE 1″ WALL SPACE

## GET 2″ to 3″ DRY INSULATION VALUE

*At 12¢* a Square Foot*







Convert to active use—for playrooms, storage, laundries, workshops, even living-quarters—basements and other areas which have walls of brick, stone, cinder or cement blocks, or poured concrete.

Create comfortable *insulated* areas in factories, warehouses, piers, terminals, garages, etc.

This requires solving the twin problems of insulating against DAMPNESS and HEAT LOSS.

The solution: Install TWO or THREE aluminum sheets, spaced to create FOUR reflective air spaces. They are vapor-proof with ZERO permeability; non-condensation-forming; and waterproof.

The air spaces practically eliminate heat flow by CONDUCTION. The aluminum surfaces throw back 95% to 97% of heat RADIATION, and block heat flow by CONVECTION.

Pre-fabricated with tough, accordion aluminum sheets, and ONLY ONE-HALF INCH DEEP, this is commercially known as Type 4 Jr. Infra insulation.

### INSTALLATION TECHNIQUE

On 16″ centers, attach 1″ furring strips to walls. Tack flange of Type 4 Jr. to FACE of furring with staples, flat surface facing room. Nail rough lattice strips over flanges. This prevents contact with wall and creates additional air space. Finally attach wallboard or lath for plaster.

*Cost of furring, lattice strips and Infra installed, 12¢ sq. ft.

**TYPE 4 Jr. THERMAL FACTORS, IN 1″ SPACE**

| | | |
|---|---|---|
| Wall-Heat | C.150, R 6.66 = | 2¾″ dry rockwool |
| Down-Heat | C.097, R 10.30 = | 4⅛″ dry rockwool |
| Up-Heat | C.194, R 5.15 = | 2⅛″ dry rockwool |

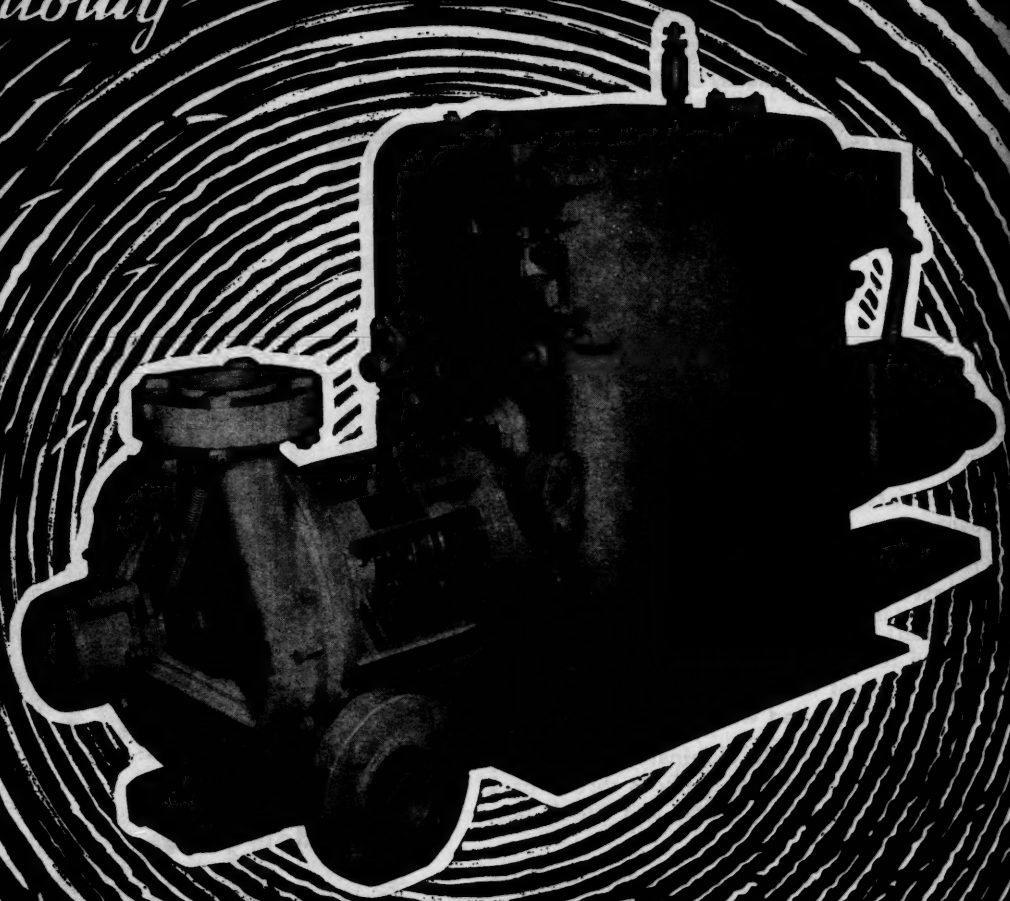
Write for technique of installing Infra Type 4 Jr. under floors.

INFRA INSULATION, INC.
525 B'way, New York, N. Y. Dept. V-3
Please send Techniques for Installing Infra Type 4 Jr.
Name_____
Firm_____
Address_____
☐ Send prices of Infra Insulations
☐ Send Sample

***INFRA INSULATION, INC.***

*525 Broadway, New York, N. Y. — WORTH 4-2241*

*Centralized Heating Economy*



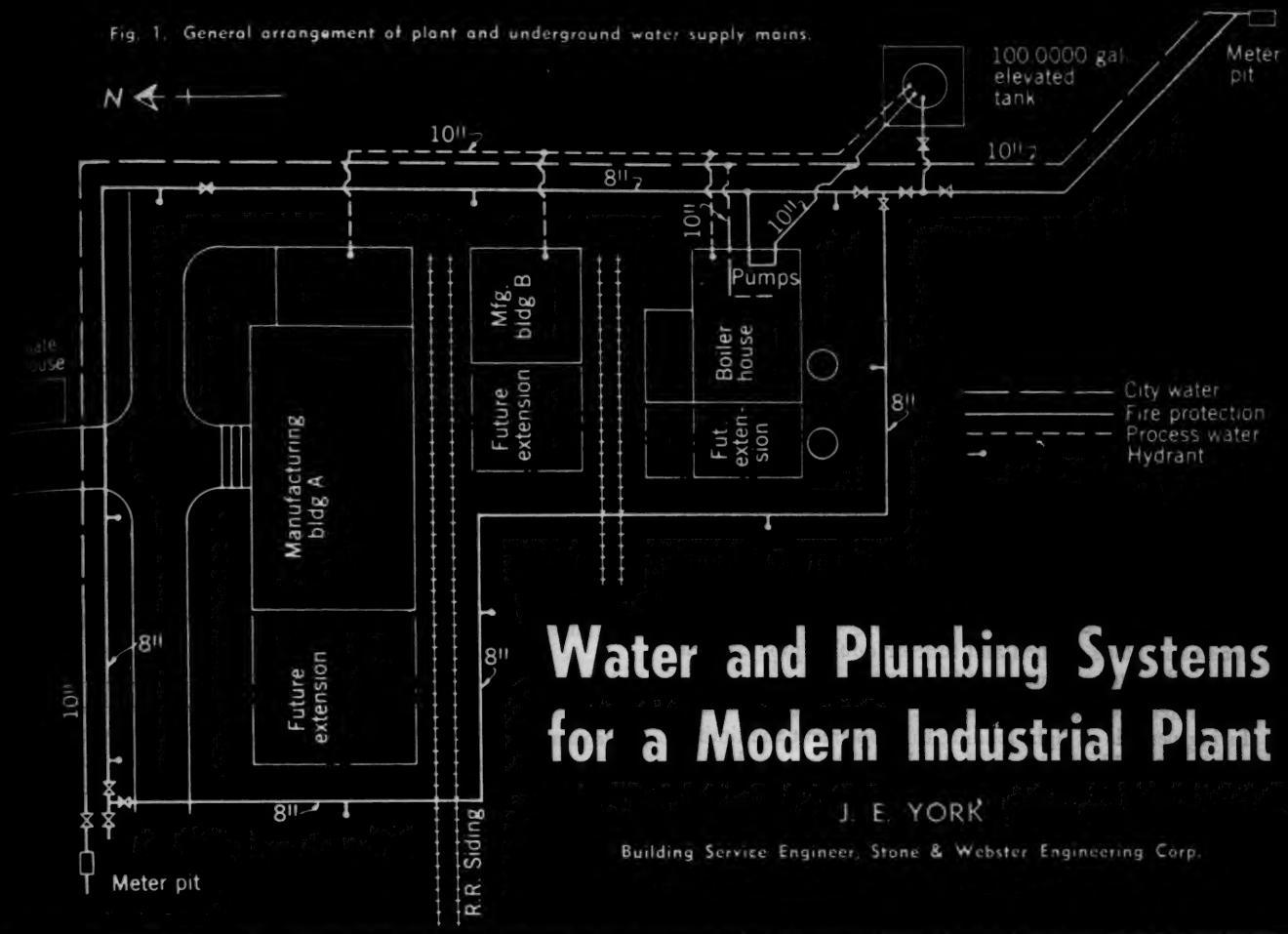
**A RETURN LINE VACUUM PUMP THAT CUTS HEATING COST.**

This unusual pump needs no electric current, cutting out greatest item of pump operating expense.

More important, this pump insures absolutely uniform circulation in system. That means continuous steam economy.

Simple, compact, one moving element, no wearing parts, no internal lubrication. Bulletin No. 203 gives the facts. Your copy is waiting.

THE NASH ENGINEERING COMPANY
SOUTH NORWALK, CONNECTICUT, U. S. A.




# Water and Plumbing Systems for a Modern Industrial Plant

J. E. YORK
Building Service Engineer, Stone & Webster Engineering Corp.

**This is the first of a two-part article which covers the design of piping systems for an industrial plant. Part 1 deals with mains for water supply, process water, and fire protection. Part 2, to follow, is devoted to the design of mains for plumbing systems.**

MODERN industrial plants are frequently users of large quantities of water and considerable thought must be given to the needs of a plant in the early stages of its design to insure that adequate quantities of water at the proper pressures and temperatures and from a suitable source can be supplied to the locations where required.

## Water Services Which May Be Required

Water may be required for several or all of the following services:

(1) Water at temperatures suitable for direct process cooling, the cooling requirements of compressed air systems, and for the condensers of refrigeration systems for process, cold storage and air conditioning. Water may be needed for washing and mixing.

(2) Chilled water for special process cooling requirements where the water temperatures required are below the temperature of the water available from city water mains, wells or other sources.

(3) Boiler feed and water treatment plants.

(4) Fire protection supplies for yard hydrants, interior hose and sprinkler systems.

(5) Cold water at temperatures up to 80F and hot water at temperatures up to 140F for the regular sanitary facilities.

(6) Hot water at 180F for dish washing in the plant cafeteria.

(7) Drinking water at about 45F for bubblers at scattered locations.

## Sources of Supply

In most cases, the source of water supply will be the city water mains, but when potable water is not required, sources of supply may be wells, nearby streams, ponds or even sea water. In any case, the seasonal temperature ranges, pressure variations, quantities available and the quality of the water must be checked before any of these supply sources are selected.

When there is any doubt about the potability of the water or its suitability for particular process requirements,

samples of the water should be submitted for analysis and approval by qualified specialists in this field.

If the source of supply is the city water mains, the engineers of the local water department should be consulted to determine if the required quantity of water can be supplied without causing a serious drop in pressure in the mains or without interference with other water consumers on the system.

At the present time, many cities and towns have found that water demands have so exceeded the anticipated requirements, and the installation of additional pumping equipment and mains is so costly, that every effort must be made to hold to a minimum the water requirements of any new plant.

In such cases, some thought should be given to possibilities of water reuse, providing the water has not become contaminated or too warm during its initial use. Use of cooling towers to dissipate the heat absorbed by the water, thereby permitting constant reuse in the system, may result in a considerable reduction in the estimated water requirements. Where heavy refrigeration loads occur, it will frequently be possible to use evaporative type condensers in place of shell and tube or double pipe condensers, with water savings of 90% or more.

Elevated storage tanks may be used for storing water during periods of light loading to supplement the limited supply available during peak load conditions on the system, and to provide a reserve for use in case of any temporary failure of the supply system.

It is always desirable to consult the regulations of the local water and health departments in regard to connections to and from storage tanks, direct cross connections with other sources of water supply, and direct connections to equipment which might, under certain conditions, cause contamination of the water supply. Many departments have strict regulations to prevent a potable water supply from becoming contaminated through a cross connection to an industrial water supply. Often although cross connections are prohibited, roll over connections may be permitted.

Meters for checking the actual amount of water used are commonly furnished by water departments without charge, but they must be installed at the entrance to the property and in accordance with the standards of the water department serving the area.

In some cases, meters need not be installed on the fire protection mains. In other cases, meters are required, but there is no charge for water used in putting out a reported fire, but water lost by leakage or taken from the fire mains for other purposes is metered and is charged for. Special compound meters make it possible to tell approximately what water is used for fighting fires.

Where sea water must be used, it is necessary not only to consider its corrosive effect on the piping and equipment, but also the possibility of deposits plugging small pipes or passages through equipment due to high temperatures. This may not only restrict or entirely shut off the flow of water, but will also reduce the heat transfer rate between the water and the hot metal surfaces, causing excessive and possibly dangerous temperatures at the equipment.

The effect of the variation in level due to tides must be considered when arranging for the purchase and installation of pumping equipment to take water from the ocean.

Water from shallow wells generally will not be suitable for drinking purposes and the continuity of supply may be uncertain. Water from deep wells, adequately designed and installed, will generally be more reliable in quantity but may have such a high mineral content as to make it unsuitable for plant use without treatment to precipitate the excess minerals.

After the water source has been selected, it is necessary to determine the water requirements of the plant and to design a distribution system that will be adequate for the needs of the plant. To illustrate the procedure to be followed in the design of the piping systems for the various services enumerated in the beginning of this article, a plant for the manufacture of a household commodity has been selected and its water requirements will be determined.

### Description of the Plant

The plant, Fig. 1, is located on a lot which has a frontage of about 700 ft and a depth of about 1,000 ft. It consists of three principal buildings, the largest of which, Building A, is a five-story building of reinforced concrete with brick exterior walls.

Building A is located at the front of the lot and is approximately 275 ft long by 120 ft wide with a tower section at the east end approximately 55 ft by 100 ft and seven stories high. It is used for the final processing and packaging of the product and the water requirements are given later in this article.

Building B, immediately to its rear, is of similar construction about 80 ft square and three stories high.

The third building is the boiler plant which supplies steam to the other buildings for process requirements and building heating.

The lot is level and is situated in the industrial area of a large city and the only available source of water is the city water system. As an uninterrupted water supply is essential to the satisfactory operation of the plant, it is desirable to have two connections to the city water mains at opposite ends of the plant.

### Estimating the Water Requirements

Before discussing the water requirements of the plant with the city water department, a preliminary estimate of the probable present and future demands should be made. Where possible the water requirements for process equipment should be based on actual operating data of similar equipment or from information furnished by the manufacturer and based on tests of the equipment under various conditions of operation.

Frequently, however, such information cannot be obtained and it is necessary for the engineer to base his estimates of the water required for cooling purposes on the weight of the product to be processed per hour and the temperature range through which it is to be cooled. Heat generated by operation of the equipment must also be taken into consideration as with certain types of equipment, such as calenders or mills which require large capacity motors for their operation, the heat generated by equipment operation may equal or exceed the heat to be removed from the product.

Water requirements for condensers of refrigeration

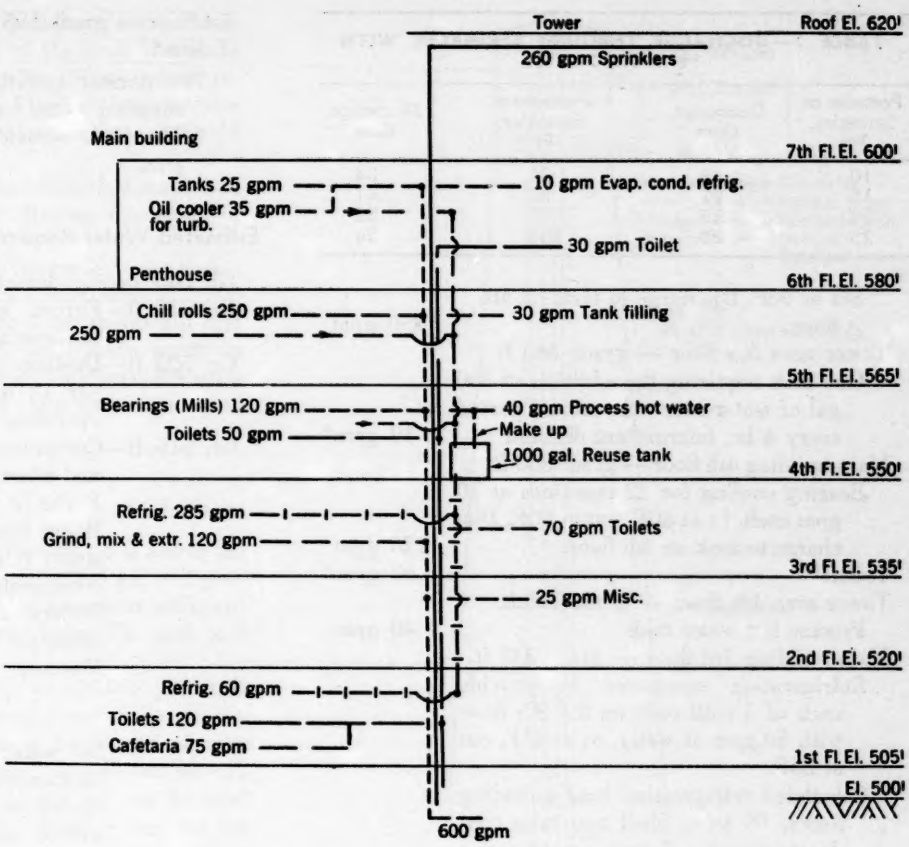



Fig. 2. Diagram showing the water requirements for various parts of Building A. Process and manufacturing needs are indicated.

systems and for intercoolers and aftercoolers of air compressors can usually be determined with a fair degree of accuracy from manufacturer's published data or can be computed from the rated capacity of this equipment.

Water requirements for filling tanks must take into consideration the quantity of water to be supplied per tank, the time allowable for this purpose, and the number of times the tank must be filled during a given period. Water requirements for washing equipment, washdown of floors and sanitary facilities cannot be determined accurately, but allowances for these requirements are usually based on arbitrary tables and load factors which have proved satisfactory in the opinion of the designer, over a period of years.

Water requirements for fire protection are commonly based on the ability to furnish sufficient water to supply the necessary hose streams to fight effectively a major fire from outside the building, or from an estimate of the quantity of water required for a limited number of sprinkler heads. It is not generally assumed that sprinkler heads in more than a limited area on one floor of a building will go off at the same time and records of fires in sprinklered buildings indicate that the number is usually very small.

## Estimated Water Requirements — Building A

The equipment requiring water on each floor and the quantity and temperature of the water entering the equipment are listed as follows and are shown in Fig. 2. Water requirements for fire protection are not included in these figures.

| Floor | Water Needs |
|---|---|
| Tower, 7th floor — grade 600 ft | None |
| Tower, 6th floor — grade 580 ft | |
| Refrigeration equipment 160 tons. An evaporative condenser can be conveniently installed on the roof nearby and allowing 250[1] Btu per minute per ton for the heat to be removed in the condenser, the water requirements may be determined as follows: | |
| $\frac{\text{Tons ref.} \times 250 \text{ Btu per min. per ton}}{8.3 \text{ (lb per gal)} \times 1{,}000 \text{ Btu (approx. heat to vaporize 1 lb water)}} = \text{gpm water}$ | |
| $\frac{160 \times 250}{8.3 \times 1{,}000} = 4.8$ gpm | Allow for 10 gpm |
| Toilet (sanitary requirements to be discussed in Part 2) | 30 gpm* |
| Main building penthouse — grade 580 ft | |
| Six storage tanks 4,000 gpm capacity each to be filled half full of water every 8 hr. Then $6 \times 2{,}000 \div 8 \times 60 =$ | 25 gpm |
| Oil cooler for turbines, in-temperature at 80F, out at 95F. Discharge to tank on 4th floor. | 35 gpm |
| Main building 5th floor — grade 565 ft | |
| Five chill rolls each 50 gpm in at 80F, | |

[1]One ton refrigeration = 200 Btu per minute; 50 Btu additional is allowed for heat added by compression of refrigerant gases.
*Occasional peak demands, gpm.

**TABLE 1—DISCHARGE THROUGH SPRINKLER WITH ½ INCH ORIFICE**

| Pressure at Sprinkler, Psi | Discharge, Gpm | Pressure at Sprinkler, Psi | Discharge, Gpm |
|---|---|---|---|
| 10 | 18 | 35 | 34 |
| 15 | 22 | 50 | 41 |
| 20 | 25 | 75 | 50 |
| 25 | 28 | 100 | 58 |

out at 90F. Discharge to tank on 4th floor. 250 gpm

Tower area 5th floor — grade 565 ft

One tank requiring the addition of 300 gal of water over a 10-minute period every 4 hr, intermittent demand 30 gpm*

Main building 4th floor — grade 550 ft

Bearing cooling for 12 machines at 10 gpm each, in at 80F, out at 90F. Discharge to tank on 4th floor. 120 gpm

Toilets** 50 gpm*

Tower area 4th floor — grade 550 ft

Process hot water tank 40 gpm

Main building 3rd floor — grade 535 ft

Refrigeration equipment to provide each of 4 chill rolls on the 5th floor with 50 gpm of water, in at 45F, out at 55F.

Calculated refrigeration load including losses, 95 tons. Shell and tube condenser requires 3 gpm reused water per ton of refrigeration. Water in at 90F, out at 100F. 285 gpm†

Cooling water for equipment for grinding, mixing and extruding product, 4 machines at 30 gpm each, in at 80F, out at 95F. 120 gpm

Tower area 3rd floor — grade 535 ft

Toilets** 70 gpm*

Main building 2nd floor — grade 520 ft None

Tower area 2nd floor — grade 520 ft

Miscellaneous 25 gpm*

Main building 1st floor — grade 505 ft

Toilets** 120 gpm*

Cafeteria equipment (See Cafeteria Requirements, part 2). 75 gpm*

Refrigeration for cafeteria and cold storage rooms. Twenty tons at 3 gpm of reused water from tank on 4th floor, in at 90F, out at 100F. 60 gpm†

The normal quantity of water to be supplied to the building will be 600 gpm.

The sum of the peak occasional demands is 400 gpm with a probable simultaneous demand of not more than 175 gpm. Water collected in tank on 4th floor at 90F, 405 gpm. The reused water will be 345 gpm.

## Estimated Water Requirements—Building B

3rd floor — grade 535 ft

Heat exchangers, 4 each 100 gpm of water, in at 80F, out at 100F. 400 gpm

1st floor — grade 505 ft

Toilets** 50 gpm*

The normal quantity of water to be supplied to the building is 400 gpm. The peak occasional demand is 50 gpm.

## Estimated Water Requirements of Boiler Plant

Gr. 545 ft—Condensate cooler 5 gpm

Gr. 530 ft—Forced and induced draft fan bearings 15 gpm

Gr. 525 ft—Dustless unloader for 1 hr per 12 hr period of stoker operation 50 gpm

Gr. 515 ft—Compressor with intercooler and aftercooler 35 gpm

Boiler feed pump bearings 15 gpm

Boiler feed based on 25% of steam returned to boiler as condensate.

Boilers deliver 285,000 lb steam per hr (75% make-up)

$$\text{Make-up} = \frac{0.75 \times 285{,}000}{60 \times 8.3} = 430 \text{ gpm}$$

No water requirements for backwashing filters are included as the backwashing will be done during off-peak periods.

Toilets** 50 gpm*

The normal quantity of water to be supplied to the boiler plant is 550 gpm and 50 gpm occasional.

The total normal quantity of water to be supplied to the plant from the city mains for the three buildings is 1,550 gpm. Allowing for a 50% increase in the process water requirements of the plant, the total is 2,300 gpm.

The total computed occasional demand for the plant is 500 gpm, but it is probable this demand will never exceed 300 gpm at any time and this amount only for a few minutes at a time.

## Fire Protection Requirements

Both manufacturing buildings are to be protected throughout with sprinklers and hose risers with 1½-inch hose so located that every part of each building can be reached with not more than 50 ft of hose.

The standards of the National Board of Fire Underwriters for the installation of sprinkler equipment specify for ordinary hazard occupancy that the water supply to the sprinkler system shall, when a flow test is made from an outside hydrant, provide a residual pressure at the hydrant when delivering 500 gpm, to give not less than 15 psi under the roof. This is to allow only for the loss of pressure due to the height of the roof above the hydrant.

The discharge capacities of approved type sprinklers having a ½-inch orifice or its equivalent in discharge, at pressures up to 100 psi, are given in Table 1.

*Occasional peak demands, gpm.

**Sanitary requirements for the buildings are covered in Part 2 of article to follow.

†Water from tank on 4th floor, gpm.

Records of fires in sprinklered buildings over a long period indicate that in over 90% of the fires, not more than 12 sprinklers go off which, with 15 psi, would require 264 gpm. Assuming that two 1½-inch hose streams were also put into operation, the total water demand would not exceed 450 gpm.

For fighting fires from outside the building, a maximum of four 2½-inch hose streams each having a capacity of 250 gpm may be allowed.

Discussions with the water department indicate that a normal demand of 2,000 gpm with a maximum of 2,500 gpm can be supplied from the city water mains but that during the summer months when peak loads occur in homes and industrial and commercial buildings, the pressure in the mains at the site of the plant may be down to 50 psi.

### Elevated Water Tank

An elevated water tank with the bottom 35 ft above the highest roof level and a capacity of 60,000 gal will provide sufficient head for the sprinkler system or sufficient water for four hose streams for one hour. The tank and connections are shown in Fig. 3.

By increasing the tank capacity to 100,000 gal, it is possible to provide adequate capacity and pressure for plant process requirements for about 20 minutes in case of interruption to the supply. The piping system should be so arranged that only the top 40,000 gal can be used for process needs and the lower 60,000 gal is reserved for fire protection. To guard against any possible contamination of the city water supply, the tank should be filled from above the maximum water level in the tank. The tank must be heated to protect against freezing in the cold weather.

This arrangement meets the requirements of the Fire Underwriters, the local water and fire departments, and health authorities.

### Pumping Equipment

The initial maximum anticipated demand on the city water mains is 1,550 gpm with a possible future additional demand of 750 gpm.

Two pumps, each having a capacity of 750 gpm are

**TABLE 2—EQUIVALENT LENGTH OF PIPE, CITY MAIN TO PUMP SUCTION**

| Section | Part | Equivalent Pipe Length, Ft | |
|---|---|---|---|
| | | 10-Inch Main | 8-Inch Main |
| A | Main | 50 | 50 |
| | Tee | 15 | 13 |
| | Gate Valve (Open) | 5 | 4 |
| | L. R. Ell | 16 | 13 |
| B | Main | 795 | 795 |
| | L. R. Ell | 16 | 13 |
| C | Main | 490 | 490 |
| | S.O. (side outlet of) Tee | 55 | 45 |
| D | Gate Valves (2) | 12 | 8 |
| | Check Valves | 65 | 50 |
| | Main | 38 | 38 |
| | S.O. Tee | 55 | 48 |
| | L. R. Ell | 16 | 13 |
| | Total | 1,628 | 1,580 |

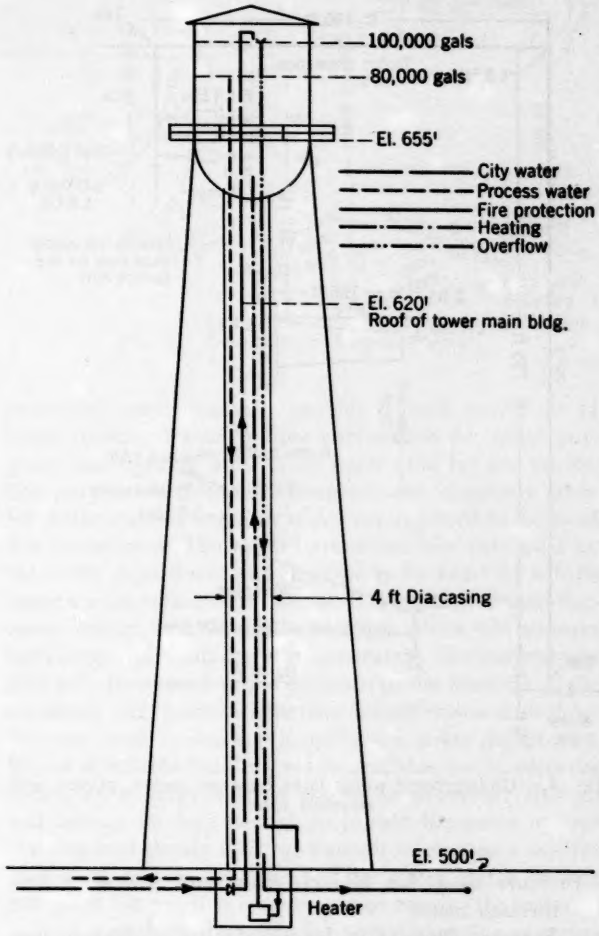



Fig. 3. Water lines at elevated tank.

provided on the ground floor of the boiler plant to take water from the city mains and discharge it above the top of the elevated tank. Provision is made for the installation of a third pump of the same capacity when required because of plant expansion.

The first of the two pumps to be installed initially will start when the level in the tank drops 18 inches and the second pump will start if the water level drops another 12 inches. Both pumps will shut off when the water level reaches normal, which is 6 inches below the bottom of the 12-inch overflow pipe.

A cross connection is provided from the discharge header for the pumps which ties directly into the underground fire main in case the elevated tank should be damaged or if it is desired to boost the pressure in the fire mains above the pressure due to the water level in the tank.

### Suction Pressure at Pumps

The arrangement of the city water main between the point of entry at the northwest corner of the property and the suction connection to the pumps is shown diagrammatically in Fig. 4, and the suction pressure at the pumps is computed with one, two and three pumps in operation. Losses are computed for 10-inch and 8-inch mains using values given in Cameron Hydraulic Data published by Ingersoll-Rand Co. These are listed in Table 2.

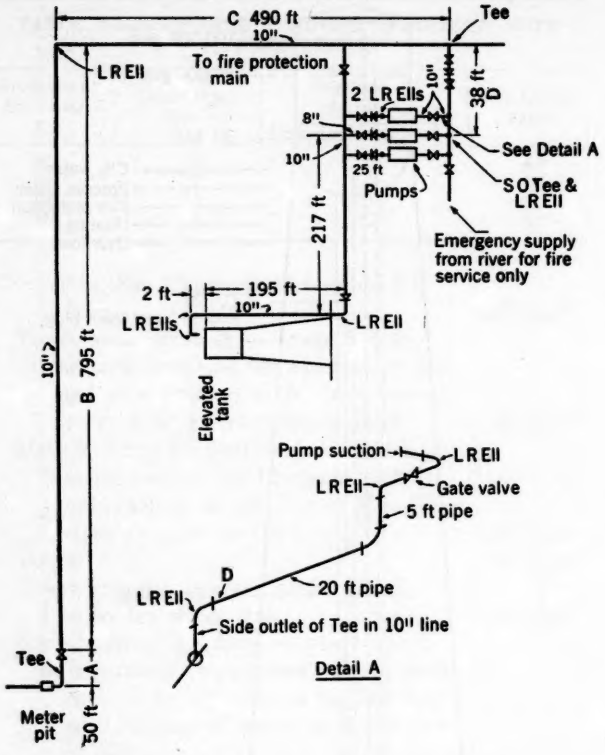



Fig. 4. Underground water lines between meter, pumps and elevated tank.

Pressure drop for 10-inch main, not including loss through meter

Pressure drop, ft = length of pipe × friction loss for flow per 100 ft.

$$\text{At 750 gpm (one pump)} = \frac{1{,}628 \times 0.594}{100} = 9.7 \text{ ft}$$

$$\text{At 1,500 gpm (two pumps)} = \frac{1{,}628 \times 2.13}{100} = 35 \text{ ft}$$

$$\text{At 2,250 gpm (three pumps)} = \frac{1{,}628 \times 4.50}{100} = 73 \text{ ft}$$

Pressure drop for 8-inch main

$$\text{At 750 gpm (one pump)} = \frac{1{,}580 \times 1.75}{100} = 28 \text{ ft}$$

$$\text{At 1,500 gpm (two pumps)} = \frac{1{,}580 \times 6.32}{100} = 100 \text{ ft}$$

$$\text{At 2,250 gpm (three pumps)} = \frac{1{,}580 \times 13}{100} = 206 \text{ ft}$$

With an initial pressure in the city water mains of 50 psi or approximately 115 ft head, it is apparent the 8-inch main would be too small with more than two pumps in operation and a 10-inch main will therefore be provided.

From the 10-inch main an 8-inch suction connection will be run to each pump and the equivalent length and the pressure drop will be as follows:

Pipe 25 ft, 3 long radius elbows 39 ft, 1 gate valve 4 ft or an equivalent length of 68 ft and a pressure loss at

$$\text{750 gpm of } \frac{68 \times 1.75}{100} = 1.2 \text{ ft}$$

The total pressure drops with one, two and three pumps are listed in Table 3.

**TABLE 3—PRESSURE DROPS FOR VARIOUS INSTALLATIONS**

| Item | One Pump, 750 gpm | Two Pumps, 1,500 gpm | Three Pumps, 2,250 gpm |
|---|---|---|---|
| | Pressure Drop Ft | | |
| 8-inch Hersey current meter | 4 | 16 | 32 |
| 10-inch main | 9.7 | 35 | 73 |
| 8-inch branch | 1.2 | 1.2 | 1.2 |
| | 14.9 | 52.2 | 106.2 |
| or | 6.5 psi | 23 psi | 46 psi |
| Pressure at pump suction | 43.5 psi | 27 psi | 4 psi |

Pump Discharge Pressure

The equivalent length of the 8-inch branch from the pump discharge as shown in Fig. 4 is as follows:

8-inch pipe, 25 ft; 2 long radius elbows 26 ft; 1 check valve, 50 ft; 1 gate valve, 5 ft; equivalent total length, 106 ft, and a pressure loss at 750 gpm of

$$\frac{106 \times 1.75}{100} = 1.9 \text{ ft approx.}$$

10-inch main to discharge 2 ft above top of tank including check valve.

10-inch horizontal main, 217 ft; 10-inch vertical main, 197 ft; S. O. Tee, 55 ft; 3 long radius elbows 48 ft; equivalent total length, 515 ft.

Friction head with one pump at 750 gpm =

$$\frac{515 \times 0.59}{100} = 3 \text{ ft}$$

Friction head with two pumps at 1,500 gpm =

$$\frac{515 \times 2.13}{100} = 11 \text{ ft}$$

Friction head with three pumps at 2,250 gpm =

$$\frac{515 \times 4.35}{100} = 22.5 \text{ ft}$$

Static head = 197 ft

Total head approximately for one pump is 200 ft; two pumps, 208 ft; three pumps, 219 ft or, respectively, 87, 90, and 95 psi.

The total dynamic head under various conditions of operation will equal the discharge head on the pump minus the pressure at the suction.

| One Pump Operating | Two Pumps Operating | Three Pumps Operating |
|---|---|---|
| (87—43.5) = 43.5 psi or 100 ft | (90—27) = 63 psi or 145 ft | (95—4) = 91 psi or 210 ft |

The pumps selected should operate with reasonable efficiency and without danger of overloading the motor under any of these conditions.

The general arrangement of the process water mains with the lengths of piping and the estimated present and future water demands is shown in Fig. 5.

The total estimated future demand is 2,250 gpm and the total equivalent length of pipe and fittings between the point of entrance *A* at the tank and the equipment at *J* in Building A is estimated as approximately 1,000 ft.

The required head pressure at the equipment located at *J* is 30 ft and the total head available to take care of friction loss through the piping system will therefore be 185—(80+30) or 75 ft. The piping system should therefore be designed on the basis of an average pressure loss of 7.5 ft per 100 ft equivalent length of pipe. Table 4 lists pipe sizes, water requirements and pressure losses to provide a basis for determination of the size pipe to be used.

With pipe sizes selected, the pressure drop from *A* to *J* will be the total of the following pressure drops:

*A-D*: 10-inch main, 290 ft pipe; 2 10-inch L. R. ells = 32 ft pipe; 1 S. O. tee, 55 ft pipe. Total = 377 ft.
377 ft at 2,250 gpm = 377 × 4.35/100 = 16.5 ft pressure drop.

*D-E*: 8-inch main, 90 ft pipe; 8-inch S. O. tee = 45 ft. Total = 135 ft.
135 ft at 1,400 gpm = 135 × 5.56/100 = 7.5 ft

*E-G*: 6-inch main, 135 ft pipe; 2 6-inch L. R. ells = 20 ft pipe. Total = 155 ft.
155 ft at 900 gpm = 155 × 9.95/100 = 15.4 ft.

*G-H*: 5-inch main, 80 ft; 5-inch S. O. tee = 25 ft pipe. Total = 105 ft.
105 ft at 600 gpm = 105 × 11.7/100 = 12.25 ft.

*H-J*: 4-inch main, 250 ft.
250 ft at 300 gpm = 250 × 9.38/100 = 23.5 ft

The total friction loss will therefore be 75.15 ft which is within the required limits.

Flow of 600 gpm is average between 900 gpm at bottom of riser and 300 gpm at top of riser.

### Meters

Meters are generally required by the water department to measure the water used by the consumer for other than fire protection needs. Meters may also be required on fire protection supply mains to provide a check on the use of water from hydrants or hose connections for other purposes than fighting fires. If the water used for fire protection purposes is metered, allowances are commonly made for water used during fires which are reported to the local fire department. The meters are commonly furnished by the water department and the type to be installed will be based on the nature of the demand. When the demand fluctuates widely, meters must be of a type which will measure both large and small demands accurately. The meters must generally be located at the entrance to the property of the consumer and located where they are accessible at all times for easy reading and servicing by the water department. Where a suitable building is not available for housing the meter, an underground pit should be provided. This pit will usually be deep enough to protect the meter against freezing and should be large enough to provide space for shut-off valves on each side of the meter and a by-pass around it for use if it is necessary to remove the meter.

It is sometimes desirable for cost accounting purposes to provide meters for individual building or special services in a building. These meters are furnished by the owner and the meter manufacturers should be consulted regarding the best type of meter for such services. These meters generally are of the conventional type to measure the total quantity of water used over fixed periods. Meters which register the fluctuations in demand or directly indicate the rate of flow are very rarely provided and because of this, the actual water requirements of most equipment can only be roughly estimated. In the majority of installations, many gallons of water which are not needed are continually being wasted because valves on the water supply system are opened wide regardless of the actual requirements.

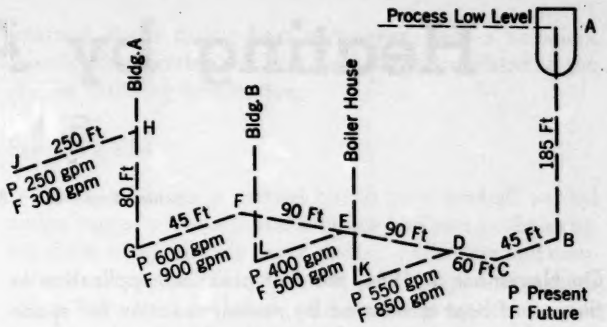



Fig. 5. Distribution of process water.

**TABLE 4—PROCESS WATER MAIN DATA FOR SIZING PIPE**

| Section | Demand, Gpm | Pipe Size, Inches | Pressure Loss, Ft per 100 Ft* | Pipe Size Selected, Inches |
|---|---|---|---|---|
| A-D | 2,250 | 10 | 4.52 | 10 |
| A-D | 2,250 | 8 | 12.8 | |
| D-E | 1,400 | 10 | 1.88 | |
| D-E | 1,400 | 8 | 5.56 | 8 |
| D-E | 1,400 | 6 | 22.5 | |
| E-G | 900 | 8 | 2.46 | |
| E-G | 900 | 6 | 9.95 | 6 |
| G-H | 600 (Avr.) | 5 | 11.7 | 5 |
| H-J | 300 | 5 | 3.17 | |
| H-J | 300 | 4 | 9.38 | 4 |
| D-K | 850 | 8 | 2.21 | |
| D-K | 850 | 6 | 8.95 | 6 |
| E-L | 500 | 6 | 3.36 | |
| E-L | 500 | 5 | 8.15 | 5 |

*From Cameron Hydraulic Data.

### Fire Protection Mains

The size of the fire protection main is generally determined by the standards of the National Board of Fire Underwriters and for a plant of the size and type under consideration, an 8-inch main should be provided. This is looped around the plant and so valved that in case of a break or the necessity for making changes in a section of the pipe, only a portion of the system will be out of service. Hydrants should be so located that not more than 250 ft of hose is required for the protection of any part of the plant in which a fire may occur. Hydrants should be self-draining when shut off and should be equipped with hose outlets similar to those used by the local fire department.

# Heating by Atomic Energy

G. M. HARBERT

Senior Engineer to Britain's Ministry of Works

**On November 5, 1951, the first practical application in the use of heat generated by nuclear reaction for space heating was successfully made at the Atomic Energy Research Establishment, Harwell, England, as a result of close collaboration between Britain's Ministry of Supply staff and the engineers of the Ministry of Works.**

EARLY IN 1946 the possibilities of utilization were foreseen, so that provision had been made in the cooling system of the atomic pile (known as BEPO, the larger of the two piles at Harwell) for the subsequent addition of a heat exchanger, whereby the heat which has been removed from the pile by the air coolant can be transferred in part to a water circuit.

The constant hot water which will flow through the pipes of this circuit is obtained by placing a heat exchanger, Fig. 1, in the outlet air duct of the pile's air cooling system, Fig. 2. Here there is a by-pass fitted with a damper which can be adjusted to vary the proportion of the air flow passing through the heat exchanger, Fig. 3. Hot water from the exchanger is then circulated in a closed circuit by a small pump to a secondary water-to-water heat exchanger. This supplies hot water for space heating and domestic hot water supplies.

At present the air temperature at the primary heat exchanger is 135F, and the water itself is heated to 130F. In 1952, when modifications to the pile have been completed, these temperatures will be substantially increased.

There is no danger from radio-activity and the water can safely be used for washing.

The heat output designed for the first building is one million Btu per hour, but for the final installation the maximum output will be 7,000,000 Btu per hour. The total floor area now being heated is 32,000 sq ft and the volume of space is 330,000 cu ft.

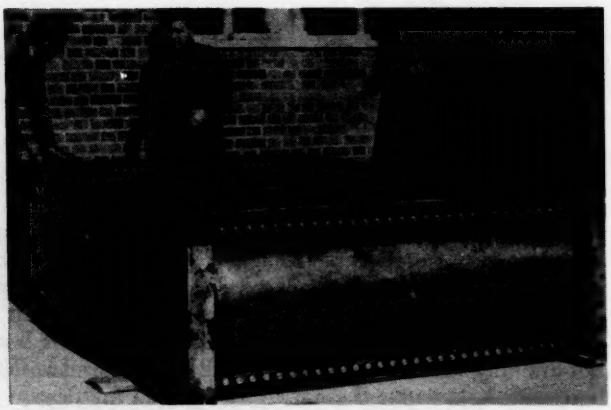


Fig. 1. The primary heat exchanger before installation.

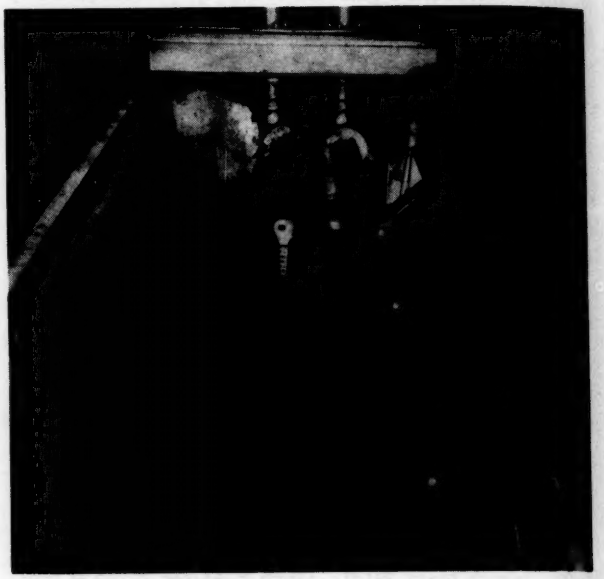


Fig. 2. Heat exchanger after installation in the outlet airduct of atomic pile at Harwell.

When the system is extended to include other buildings no other primary heat exchanging apparatus will be required, and it will only be necessary to connect the piping.

The installation was carried out by the Ministry of Works in collaboration with the Engineering Division, A.E.R.E. The heat exchanger, measuring 10 ft x 10 ft x 2 ft 6 in weighs eight tons.

The building selected for the first stage of the scheme for utilizing heat from BEPO is a three story block comprising laboratories and offices; the former are heated by floor coils and plenum air, while the latter are provided with hospital type radiators. The floor coils and radiators are fed with hot water at a temperature of 100F with pump-assisted circulation from two heat exchangers, one for each half of the building. The heat exchangers are normally supplied with dry saturated steam at 120 lb per sq inch. The plenum air is heated by its passage over finned tube heater batteries fed with steam. In addition, service hot water is provided by two hot water storage type calorifiers.

No attempt has been made to use BEPO heat for the plenum air, because of (a) the large size of a heater battery to heat the plenum air from a hot water circuit which has been designed for initial flow temperature of 160F and a return temperature of 130F, and (b) the necessity of retaining facilities for the use of steam during such periods as the pile is not operating.

## Four Conditions

It was, therefore, decided to deal only with the floor

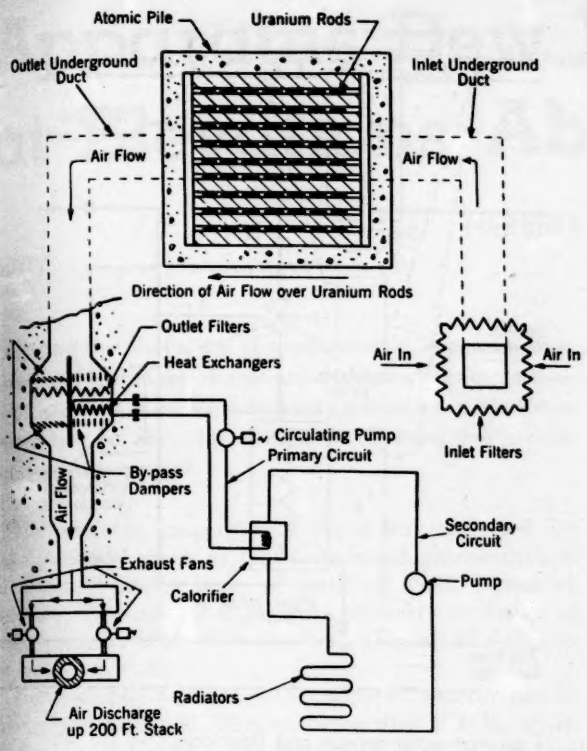



Fig. 3. Schematic diagram of atomic pile heat exchanger circuits.

coil system and the service hot water supply; the two systems produce separate and distinct problems.

The conditions for which the systems have been designed are:

(a) Facilities for operating on steam shall be retained;
(b) Change over from steam to BEPO heat and vice-versa shall be entirely automatic;
(c) Maximum use to be made of BEPO heat; if of insufficient temperature, the system to be boosted by steam;
(d) The possibility of reverse heat transfer from steam to the BEPO fluid must be avoided.

The plant for which the Ministry of Works has been responsible comprises three main items—the circulating hot water pump, the distribution mains, and the calorifier and control equipment in the building.

The water pump is of the conventional centrifugal type capable of delivering 500 gpm against a head of 65 ft, and is driven by a three phase 415 volt electric motor. The pump is situated adjacent to the heat exchanger, and is in the flow line in order to reduce the pressure on the heat exchanger. This pump motor is remote controlled from the pile control room and is put into operation when the reactor is working. The duty of the heat exchanger is adequate to serve further heat loads which will be connected when operating experience has been gained on the present installation. The pump has accordingly been designed to meet the added friction head that will occur and to maintain the correct velocity of fluid through the heat exchanger to obtain the optimum heat transfer. As these rates are greatly in excess of initial requirements, a by-pass is fitted between the flow and return mains immediately after the pump, thus enabling the fluid to be returned direct to the heat exchanger, only a sufficient quantity for meeting the heat load being circulated to the present building installation.

## Fed in Parallel

The distribution is carried out in mild steel all welded mains lagged with sectional asbestos and run in the existing ducts which already carry steam, condensate and compressed air mains. Stainless steel, bellows-type, expansion joints have been included, allowance having been made for a maximum ultimate operating temperature of 200F.

The building equipment consists of two similar plants, each serving one half of the building, which is divided vertically for services, and fed in parallel from the mains.

The original heating plant comprised a steam operated calorifier heating water to 100F which was circulated through floor coils and radiators by a pump on the return line. Steam flow to the calorifier is controlled thermostatically and by variostat on two automatic valves in the steam feed to the calorifier. To utilize the BEPO heat, a water to water calorifier has been introduced, the primary circuit connected through isolating valves to the BEPO heat mains and the secondary circuit connected between the circulating pump and the return inlet to the steam calorifier. The former is provided with a shunt bypass controlled by a two-way, motor-operated, modulating, mixing valve. According to the valve position (A or B in Fig. 4), the flow is from the circulating pump through the bypass and then to the steam calorifier; or from the circulating pump, through the water to water calorifier and then to the steam calorifier. Intermediate positions of this valve provide a partial passage of the flow from the heat emitters through the water to water calorifier. Let the fluid temperatures be defined as follows: BEPO incoming main—$T_1$; outlet from building circulating pump i.e. building circuit return—$T_2$; inlet to steam calorifier—$T_3$; outlet from steam calorifier i.e. building circuit flow—$T_4$. When control valve is in the position A then $T_2=T_3$.

The desired operating conditions are therefore that $T_4$ must not exceed 100F and $T_2$ must not exceed $T_1$ if reversal of heat flow is to be avoided. When the pile is not in operation, $T_1$ is less than $T_2$, modulating valve is in position *A*, and the building is heated by steam in the conventional manner. On starting up the pile and the main circulating pump, $T_1$ will increase until it exceeds $T_2$ where the steam supply is cut off and the modulating valve moves to position *B*. Heat is taken into the building heating fluid with a result that $T_3$ rises until $T_3$ equals $T_4$, whereupon the steam supply is shut off. When $T_4$ begins to exceed 100F then the mixing valve modulates so that only part of the building fluid is passed through the water to water calorifier and the heat absorption is limited. On shutting down the pile $T_1$ will fall until it is less than $T_2$ whereupon the mixing valve returns to position A and steam is restored by the thermostatic control of the steam calorifier.

## Control System to be Modified

At the present time the system is controlled by a thermostat which is governed by $T_1$, and causes the steam supply to be cut off when BEPO heat is available; addi-

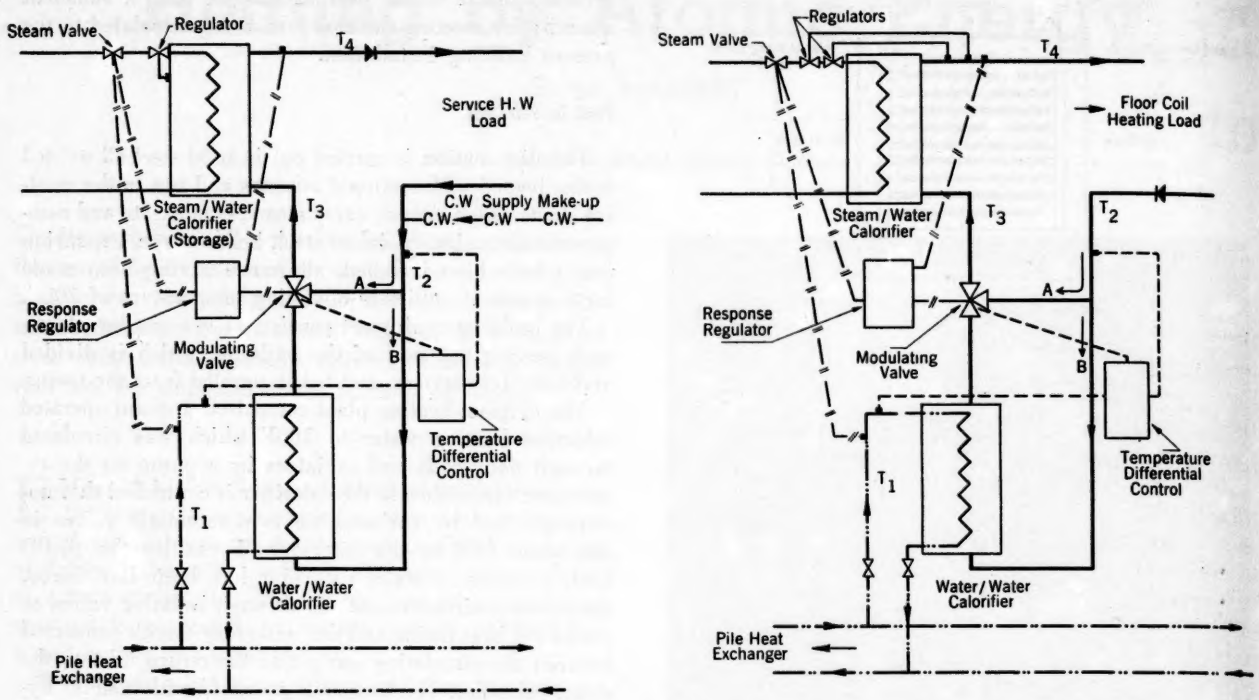



Fig. 4. Schematic diagram of heat exchanger circuits for hot water service and floor coils.

tionally the mixing valve, under the control of a thermostat measuring $T_4$ and response regulator, takes up a position such that the amount of heat passed is just sufficient to maintain the temperature of 100F to which the thermostat is set. While this arrangement meets three of the desired operating conditions, namely (a), (b) and (d) it does not deal with (c) in that partial use cannot be made of the pile heat when $T_1$, although hot, does not reach the predetermined value of its thermostat setting.

It is therefore intended to modify the control system by the substitution of a differential thermostat, to maintain a predetermined temperature difference of a few degrees between $T_1$ and $T_2$ as an overriding control of the mixing valve. The thermostat controlled by $T_1$ will then be removed and the steam supply governed by the same thermostat in $T_4$ as operates under normal steam working.

Hot water supplies are furnished by a steam calorifier of the storage type and circulation is effected by a pump in the flow line. In this case a water to water calorifier is installed; the secondary circuit being inserted between the return hot water line and the steam calorifier; shunt bypass controlled by a modulating mixing valve is fitted in a similar manner as on the heating system and the cold water feed has been removed from the steam calorifier and introduced into the return line at a point prior to the connection of the bypass.

Adopting the same definitions as before, then again $T_2$ must not exceed $T_1$ in order to preclude reverse heat flow but $T_4$ may be allowed to equal $T_1$ at least for the present when $T_1$ will not be more than 160F. Operation and control of the mixing valve is similar to that on the heating layout; in this case also it is intended to introduce a differential thermostat as in the heating system. Introducing the cold water feed to the return line immediately before entry to the calorifier will ensure that the maximum heat transfer occurs for all values of $T_1$.

Although the system has been in operation for only a few weeks, the results achieved have been considered sufficiently encouraging to justify the addition of a further heat load; two further buildings have therefore been chosen for connection to the system. In both these cases, the heating is by conventional radiators, thus necessitating a different form of control; the design work on this project is now proceeding.

## Drafts Don't Cause Colds

The British Medical Research Council reported recently that sitting in cold drafts, walking in the rain, wearing wet socks and being outside thinly clad had nothing to do with catching colds.

For years the council has been experimenting with human volunteers at Harvard Hospital in Salisbury. Since 1948 the experiments have centered on the problem of how and why people catch cold.

"In particular," the council reported, "an attempt was made to find whether measures likely to lower the resistance of the individual played an important part. This required the cooperation of volunteers who submitted to conditions of considerable discomfort, such as sitting in cold drafts, exercising in the rain, wearing wet socks, etc.

"In no case was any evidence obtained that such conditions would either bring on a natural cold or increase the susceptibility to experimental infection with the cold virus."

# Apparatus Dew Points at Elevations Above Sea Level

HERBERT HERKIMER

**Extending the discussions of psychrometry, apparatus dew point, and the effect of pressure changes at various elevations, covered in recent reference sections,[1] Mr. Herkimer shows how to allow for altitude in selecting the proper apparatus dew point.**

The variable properties of moist air illustrated by psychrometric charts or tables are based on calculations at standard atmospheric pressure of 29.92 inches of mercury. However, if it becomes necessary to design at some pressure other than standard, a means of doing so is readily devised.

For example, assume 78.16 grains of water vapor in one pound of dry air at a condition of 80F D.B., 66.7F W.B., 50% R.H. and a dew point of 60.2F at 29.92 inches of mercury, barometric pressure.

At an elevation of 4,800 feet the barometric pressure would be 24.92 inches of mercury, and the moisture content of a pound of air at 50% R.H. would be greater as shown by the formula,

$$W_s = \frac{4375\ P_s}{P - P_s}$$

Where $P_s$ = vapor pressure of water at room dew point in inches of mercury

$P$ = Barometric pressure, inches of mercury

$W_s$ = grains water per pound of dry air at saturation

$P - P_s$ = Partial pressure of the air in the mixture

The coefficient 4375 takes into account the gas constant for air and water vapor and the conversion from pounds to grains.

*Problem 1:* Estimate $W_s$ at 29.92 inches Hg barometric pressure, and at a room condition of 80F D.B., 50% R.H., a dew point of 60.2F and 66.7F W.B.

*Solution:* $P_s = 0.525$ at a dew point of 60.2F

$P = 29.92$

$$W_s = \frac{4375 \times 0.525}{29.92 - 0.525} = 78.16 \text{ gr.}$$

*Problem 2:* Find the weight ratio of water vapor to air assuming the same air conditions but at an elevation of 4,800 ft above sea level. The barometric pressure assumed is 24.92 inches of mercury.

*Solution:* $P_s = 0.525$ at a dew point of 60.2F

$P = 24.92$

$$W_s = \frac{4375 \times 0.525}{24.92 - 0.525} = 94 \text{ gr.}$$

The increase, $\triangle W_s$, of grains of moisture per pound of dry air is therefore $94 - 78 = 16$ grains, or .0023 pound.

*Problem 3:* What is the increase in latent heat content accruing to the increase of 16 grains of moisture per pound of dry air.

*Solution:* It may be assumed that the latent heat is 0.155 Btu per grain of moisture or 1085 Btu per pound between the usual dew points met with in practice from 40F to 70F.

Therefore $\triangle h = 0.155 \times 16 = 2.5$ Btu increase in the latent heat content at 4,800 feet elevation.

*Problem 4:* What is the increase in sensible heat content at an elevation of 4,800 feet. Sensible heat is product of $0.2403 \times 80 = 19.22$ Btu per pound dry air (approximately)

*Solution:* There is no increase in the sensible heat as compared with the sensible heat at sea level.

*Problem 5:* What is the total heat content at sea level under assumed conditions of 66.7 wet bulb?

*Solution:* The latest psychrometric tables indicate approximately 31.37 Btu per pound of dry air.

*Problem 6:* What is the total heat content per pound of dry air at an elevation of 4,800 feet?

*Solution:* 31.37 Btu + 2.5 = 33.87 Btu total heat per pound of dry air at 4,800 feet elevation. (Heat of liquid for 16 grains at 80F is 0.1 Btu and is neglected.)

*Problem 7:* It is estimated that to maintain a room condition of 80F D.B. and 66.7F W.B. and 50% R.H. at 4,800 feet elevation a sensible heat factor of 80% is required. What is the apparatus dew point?

*Solution:* The Herkimer charts, published in December, 1951, HEATING AND VENTILATING, are based on a barometric pressure of 29.92 inches Hg. Therefore a correction of the apparatus dew point of 57F shown on those charts at 29.92 is necessary.

By definition the sensible heat factor may be represented by the following formula

$$\frac{h_2 - h_1}{H_2 - H_1} = \text{SHF}$$

$h_2$ = sensible heat at room condition dry bulb

$h_1$ = sensible heat at apparatus dew point

$H_2$ = total heat at room condition

$H_1$ = total heat at apparatus dew point

At sea level assume

$h_2 = 19.22$ at 80F dry bulb

$h_1 = 13.692$ at 57F ADP

$H_2 = 31.37$ at 66.7F wet bulb

$H_1 = 24.48$ at 57F ADP

[1] Solving Air Conditioning Problems by Psychrometric Chart, December, 1951; and An All-Pressure Air Conditioning Chart, January, 1952.

Therefore SHF = 80%, which checks with the chart. However at 4,800 feet elevation

$h_2 = 19.22$
$h_1 = X$ (unknown)
$H_2 = 31.37 + 2.5 - 33.87$
$H_1 = Y$ (unknown)

$$\frac{19.22 - X}{33.87 - Y} = .80$$

This equation is indeterminate and therefore may be solved by trial and error. A tabulation of trial values follows:

| ADP | Sensible heat, X | Total heat, Y | 19.22—X | 33.87—Y | SHF |
|---|---|---|---|---|---|
| 58 | 13.932 | 24.12 | 5.28 | 8.75 | .60 |
| 60 | 14.413 | 26.46 | 4.81 | 7.41 | .65 |
| 62 | 14.89 | 27.85 | 4.33 | 6.02 | .72 |
| 63 | 15.134 | 28.57 | 4.09 | 5.30 | .78 |
| 64 | 15.374 | 29.31 | 3.85 | 4.56 | .85 |

Therefore an apparatus dew point between 63F and 64F corresponds to an 80% sensible heat factor at 4,800 feet elevation

A short cut is suggested as follows:

The moisture content was previously estimated at 94 grains per pound of dry air at 80F D.B. and 50% R.H. at 4,800 feet elevation. At sea level 94 grains would correspond to 80F D.B. and 60% R.H. Referring to the Herkimer 60% ADP chart a sensible heat ratio of 80% at 80F D.B. room temperature corresponds to about 64F apparatus dew point.

At 3,500 feet elevation, corresponding to a barometric pressure of 27.31 inches Hg at a dew point of 60.2F,

$$W_s = \frac{4375 \times 0.525}{27.31 - 0.525} = 86 \text{ grains}$$

which corresponds to 55% R.H. at sea level.

The effect of elevation on apparatus dew point is suggested in the following tabulation:

| Elevation | Room D.B. | Room % R.H. reduced to sea level | SHF |
|---|---|---|---|
| 0 | 80 | 50 | 80 |
| 2500 | 80 | 55 | 80 |
| 2800 | 80 | 60 | 80 |

Therefore to use the Herkimer ADP charts for various elevations it is required to find the corresponding relative humidity reduced to sea level conditions. It will be noted that the relative humidity increases at the rate of approximately one percent for each 500 feet of elevation to maintain the sensible heat factors desired.

The McElroy psychrometric chart for various pressures, published in the January, 1952, issue of HEATING AND VENTILATING offers a simple means of converting to sea-level R.H. from room conditions at an elevation.

Merely read the room condition, say 80F D.B. and 50% R.H., on the chart scale as marked. Follow the humidity ratio slope to the sea-level saturation curve. This establishes the room dew point at about 60F. Where this dew point line crosses the saturation curve for actual room elevation establishes the actual room humidity ratio. Intersection of this humidity ratio line with room dry bulb fixes the corrected relative humidity on the chart scale. If the room humidity ratio is known (as 94 grains = .013 lb), the corresponding sea-level R.H. can be read directly at the 90F D.B. line as 60%.

## How To Handle Lead Oxide Dust

Lead oxide dust and fumes have ceased to be problems for Willard Storage Battery Company. All of the battery-manufacturing operations in four of their plants are ventilated by carefully designed hoods so that the working areas are clean and dust-free. Hoods completely corral the dusty air and pass it to high-efficiency cloth-type dust collectors manufactured by American Wheelabrator & Equipment Corp. of Mishawaka, Indiana. These filter the troublesome lead dust and fumes out of the air.

One typical dust collector installation is at their Memphis, Tennessee plant. There, one collector with a cloth area of 2115 sq ft handles all the air required to ventilate a battery plate cutting machine, a conveyor housing, and a refining kettle. It keeps the air clean enough to conform to the strict Tennessee state code.

When the plates are cut on the machine, the scrap falls into a pit under the floor, from where it is conveyed to the refining kettle. There, it is re-melted with pig lead for use in other molding operations.

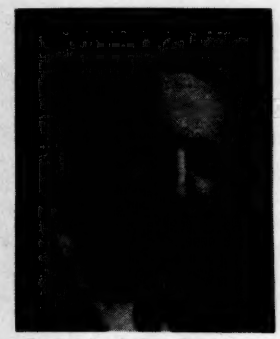
Air passing through the hoods and pit is kept at high velocity in order to collect all of the dust generated at the plate cutting machine. The conveyor is totally enclosed and ventilated by ducts. The hooding, duct work, and conveyor were designed by Willard's engineers. An attached hood for dross collection at the refining kettle traps the lead oxide fumes given off there. The hood on the conveyor discharge also ventilates the refining kettle and keeps the surrounding air clean.

The filter cloth in the Memphis installation is in the form of cotton sateen tubes. Cotton cloth was selected after a thorough study of air temperature, the corrosive properties of the dust, and all other factors determining the kind of cloth needed for satisfactory operation. At predetermined intervals, these tubes are mechanically shaken to dislodge the collected dust which then falls down into collecting hoppers. Each hopper is equipped with a swing gate valve which swings downward to empty the dust into standard lead oxide cans. To keep the hopper-emptying operation dust-free, special lids are used on the cans. One end of a tight cylindrical canvas tube is clamped to the hopper, and the other end is fastened to the special lid. When these lids are clamped on the cans, the dust being emptied out of the hoppers is prevented from escaping into the atmosphere.—EUGENE F. ANDERSON

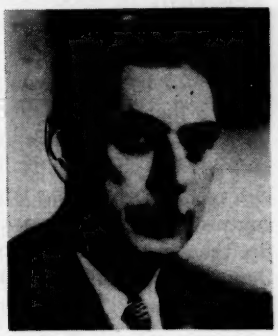
# Heating and Ventilating Industry Gathers at St. Louis

**Report of the 58th annual meeting of the American Society of Heating and Ventilating Engineers held at Hotels Statler and Jefferson, St. Louis, Mo., and abstracts of the papers that were presented at the five technical sessions.**

MORE than 1,000 heating and ventilating engineers and their guests gathered in St. Louis, Mo., January 28 to 30 to attend the 58th annual meeting of the American Society of Heating and Ventilating Engineers. For the many who arrived the day before, the local committee headed by B. L. Evans provided an afternoon tour of the city and tea to facilitate the getting-acquainted period. Technical sessions were held at the Hotel Statler; the "Meet Me in St. Louis" party and the annual banquet took place at the nearby Hotel Jefferson.



Ernest Szekely, President



R. F. Taylor, Vice President

Monday mornings was set aside for meetings of the Chapters Conference Committee and also for four TAC gatherings.

At the Welcome Luncheon, William Veeck, president. St. Louis Browns, gave a humorous and entertaining talk on Engineering a Pennant. He prefaced his talk by saying, "St. Louis is first in shoes, first in booze, and last in the American league." He told a number of humorous stories regarding the ballteam that he now heads and some of his plans for achieving a higher American league rating this season.

Following the dinner at the "Meet Me in St. Louis" party on Monday evening, there was an extensive stage review and then dancing.

At the annual banquet, Ralph Carney spoke on New Strength for America.

## Medal Award

The 1951 F. Paul Anderson Medal for "outstanding work in the field of heating, ventilating and air conditioning," was presented to Homer Addams, chairman of the board, Fitzgibbons Boiler Co., Inc., New York, and the only living charter member of ASHVE. Mr. Addams, 78 years old, was one of a group of 75 engineers who met in New York City in 1895 to form the society. He became president of the society in 1924. Mr. Addams is a charter member of the society's Philadelphia chapter. He was active in the founding of the society's research laboratory at the United States Bureau of Mines in 1919; a member of the first committee for the ASHVE Guide, and a member of the committee which conferred with the boiler code committee of the ASME.

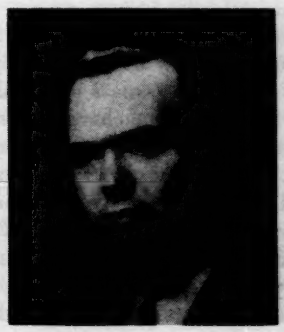
## New Officers

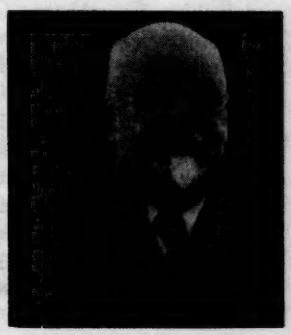
The new officers of the society are Ernest Szekely, president, Bayley Blower Co., Milwaukee, Wis., president; Reg. F. Taylor, consulting engineer, Houston, Tex., vice-president; L. N. Hunter, vice-president of research, The National Radiator Co., Johnstown, Pa., second vice-president; J. Donald Kroeker, consulting engineer, Portland, Ore., treasurer.

Mr. Szekely received his M. E. degree in 1910 from the University of Budapest, and served first as assistant and later associate professor at the university. After coming to the United States he served as designer for Guarantee Construction Co., New York; research engineer, American Blower Co.; chief engineer, Drying Systems, Chicago. From his post as chief engineer, Bayley Blower Co., he was elevated in 1932 to president of the company.

Mr. Taylor was born in Toronto, Canada, and was educated in public and preparatory schools in England and Pietermaritzburg, Natal, South Africa. He returned to Canada in 1908, and later was associated with archi-

Left to right, J. Donald Kroeker, treasurer; L. N. Hunter, second vice president; Homer Addams, awarded F. Paul Anderson medal.





tectural firms in Texas and Kansas City. He started his private engineering practice in Houston, Tex., in 1938.

Mr. Hunter, born in Brampton, Ontario, Canada, received his B. A. Sc. degree in 1925 from the University of Toronto. He served as assistant research engineer with the Bryant Heater Co., Cleveland, and then joined the staff of The National Radiator Co. as gas engineer. In 1941 he was promoted to vice-president and manager of research.

Born in Russia, Mr. Kroeker received his B. S. in Civil Engineering from Oregon State College in 1927 and his M. E. in 1937. Following graduation, he joined the staff of the AGA Testing Laboratory, Cleveland, Ohio. After work with the Pennsylvania Furnace and Iron Co., as development engineer and the Klamath Machine & Locomotive Works, Klamath Falls, Ore., he started his present consulting engineering practice in 1938.

### Members of Council and Research

The new 3-year members of Council are M. K. Fahnestock, research professor and coordinator of research, department of mechanical engineering, Engineering Experiment Station, University of Illinois, Urbana, Ill.; Peter B. Gordon, vice-president, Wolff & Munier, Inc., New York City; Raymond T. Kern, chief engineer, Jennison Co., Fitchburg, Mass.; and D. M. Mills, manager, F. J. Evans Engineering Co., Houston, Tex.

The new 3-year term members of the Committee on Research are I. W. Cotton, president, I. W. Cotton Co., Indianapolis, Ind.; Walter A. Grant, director of research, Carrier Corp., Syracuse, N. Y.; Neil B. Hutcheon, professor of mechanical engineering, University of Saskatchewan, Saskatoon, Canada; Burgess H. Jennings, professor of mechanical engineering and department chairman, Northwestern University, Evanston, Ill.; Charles O. Mackey, professor of heat-power engineering, Cornell University, Ithaca, N. Y.

Following are abstracts of papers presented at the technical sessions:

### Self-Charging Electrostatic Air Filters

Certain high dielectric plastics, resins and waxes have the property of generating an electrostatic charge under the influence of an air stream. Due to this action, the material will attract and retain fine dust particles from the air by electrostatic means. Data on this interesting subject was given in a paper on Self-Charging Electrostatic Air Filters, by W. T. Van Orman and H. A. Endres, respectively, member of the Research Division and assistant manager, Research Division, The Goodyear Tire and Rubber Co., Akron, Ohio.

The materials that are most suitable for use in self-charging electrostatic air filters develop both positively and negatively charged areas in the same mass and will, therefore, attract and retain both types of charged particles. Many of these materials will collect dust even under conditions of high humidity. A daily laboratory weight test on a full scale filter did not show any decrease in weight pick-up of atmosphere dust due to high humidity conditions. In a complete season's run in homes, about 100 test filters were in no way adversely affected by high humidity. Therefore, if the proper materials are selected, moisture is not a problem with the self-charging electrostatic filters.

Radioactive materials such as polonium, which emit rays that ionize the atmosphere and produce electromagnetic effects, will discharge the electrostatic filters and will render them ineffective.

The simplest and most convincing demonstration of the effectiveness of the self-charging electrostatic air filter is to use it in series with a conventional impingement type filter in a heating, ventilating or air conditioning system. When the electrostatic filter is placed downstream from the impingement filter, it collects dust which has passed through the latter. When the position of the filters is reversed, the electrostatic filter leaves practically no dust in the air stream that is retainable by the impingement type filter, and the latter remains substantially clean.

Polystyrene and polyethylene are predominately outstanding in their electrostatic dust pick-up. Superior performance of these two plastic materials is noted when they are applied to fibers such as glass, vegetable and animal. Rosin coated fibers are reported to have electrostatic characteristics.

Where dust allergies were encountered in homes equipped with electrostatic filters, a questionnaire revealed that in 75% of the cases there was improvement, and in 12½% there was no effect. The balance did not answer.

It is very easy to clean electrostatic filters. The directions are to rinse gently in cold water. No hot water, no detergent, no re-oiling is needed. After this simple cleaning method, the filters are drained for a few minutes and are then restored to service even though they may still be damp. It is claimed that the filters may be cleaned over and over again without loss of performance.

### Radiant Energy Emission

A well insulated flat roof on a cloudless night loses 35% more heat than when the sky is overcast, 25% more heat than when it is windy and overcast, and 15% more than when it is windy and clear. This information was given in a paper on Radiant Energy Emission of Atmosphere and Ground by George V. Parmelee and Warren W. Aubele, respectively research associate and research engineer, ASHVE Research Laboratory.

The paper, the authors point out, is intended to evaluate the significance of the effect of net exchange of low temperature radiation between the exterior surface of a building section and its surroundings on the heat flow through the building section. While the radiant energy emitted by a building surface is a function of its emissivity and its temperature, the radiant energy emitted by the outdoor surroundings is dependent on the water vapor and carbon dioxide content and temperature of the atmosphere and the degree of cloudiness as well as on the temperature of the ground and other building surfaces seen by the surface under consideration.

At night, the ground surface may be cooled below air temperature and during the day, it may be warmed by the sun. Surface temperatures of buildings are likewise affected by the weather and also by internal heat sources and sinks so that the radiant energy from ground and buildings will vary widely throughout the day. The ground contribution to the radiation received by vertical surfaces can be an extremely variable quantity because of

differences in ground cover, proximity of buildings, and the variable sun effect on building surfaces.

The authors discussed the nature, magnitude and significance of the low temperature long wave length radiation received by building surfaces from the atmosphere, the ground and other building surfaces. A special radiometer was used to obtain the experimental readings. As a result of this study, the following conclusions were established:

(1) The exchange of low temperature radiation between exterior surfaces of buildings and outdoor surroundings had been illustrated by experimental data and examples. The significance of this exchange in heat loss and heat gain calculations, as compared with convective exchanges, varies with surface orientation, clearness of the sky, dry bulb and dewpoint temperature of the air, and wind velocity.

(2) The radiant exchange cannot be treated by use of an equivalent surface conductance, but can be dealt with by a modification of the well known sol-air temperature concept.

(3) Measurements which were made of low temperature radiation received from clear skies by a horizontal surface were found to be in good agreement with the following simple equation:

$$R_h = R_{bo} (0.55 + 0.33 \sqrt{P_w})$$

in which $R_h$ is the radiation received by the surface from the sky, Btu per (hr) (sq ft), $R_{bo}$ is the radiation that would be received from a black body at air temperature, Btu per (hr) (sq ft), and $P_w$ equals the water vapor pressure at ground level, inches of mercury. It is suggested that this equation be used in design calculations pending further investigation of its applicability to various geographical locations.

(4) Examples of measurements of low temperature radiation received by vertical and inclined surfaces have been given. Because of the variability of ground surroundings from one location to another, additional observations are needed to establish the approximate magnitudes and range in this value for design use.

(5) When the sky is completely overcast with a low thick cloud cover, the radiant energy emission of atmosphere and ground very closely approximates that of a black body at air temperature.

(6) Correlation of the low temperature radiant energy emission of outdoor surroundings is needed with other weather design factors, such as cloudiness, solar radiation, dry bulb temperature and wind velocity.

### Perimeter Loop System

In a paper on Performance of a Warm Air Radial-Feeder Perimeter-Loop System in a Residence, M. E. Childs, research associate, R. W. Roose, research assistant professor of mechanical engineering and S. Konzo, professor of mechanical engineering, all of the University of Illinois, presented performance data for a radial feeder perimeter loop heating system that was installed in a low cost residence at the university designated as Warm Air Heating Research Residence No. 3.

The perimeter system consisted of an 8-inch diameter warm air duct that was embedded in concrete in the form of a single loop around the periphery of the floor. A series of radial feeder ducts, 8 inches in diameter, connected the perimeter duct with a subfloor plenum that was installed below the furnace.

The paper reported on four arrangements of feeder ducts—two with three feeders each, an arrangement using four feeders and another employing five feeders. Satisfactory temperature differentials were obtained with all of these arrangements. The average room air temperature differential for the five-feeder arrangement was 2.7 deg or about 0.8 deg lower than that obtained with the other three arrangements.

The investigators made the following generalizations:

(1) Locating the feeder ducts so that they extended into the exposed corners of the floor provided an additional heat source in an area which tended to be cool. It resulted in more satisfactory differentials in those areas.

(2) Locating the registers below windows resulted in lower differentials. This resulted from the fact that the warm air mixed with the downward current of cool air from the windows.

(3) Use of a larger number of feeder ducts generally resulted in improved differentials since the panel heating effect was increased. However, the location of the feeder ducts was more important than the number used, provided that the number of feeders was sufficient to assure an adequate delivery of warm air to all sections of the perimeter duct.

An examination of floor surface temperatures revealed that the floor surface temperatures in the kitchen were low due to the great distance along the feeder and perimeter ducts from the subfloor plenum. This low temprature area indicated the need for extending feeder ducts into corner areas as well as having all sections of the perimeter duct at relatively short air-flow distances from the subfloor plenum.

For an outdoor temperature of 30F, the maximum floor surface temperatures did not exceed 85F, except for an area within about two feet of the subfloor plenum. For average winter conditions of the locality, the floor surface temperatures in the entire living area were well below the commonly accepted maximum value of 85F.

In this test residence, a down-flow furnace was used and the warm air was forced directly from the furnace into the subfloor plenum from where it was delivered through the feeder ducts to the perimeter duct, and then into the rooms through floor registers. The air moved across the rooms to a single return air intake in the living room and then into the furnace to be reheated.

System response to sudden changes of outdoor temperatures was considered satisfactory. During periods of rapidly changing outdoor temperatures there were no signs of lag or over-run of room temperatures. Balancing the system by adjusting the shutter dampers on the floor registers proved effective.

With an outside temperature of 20F, temperature differentials from the floor level to the breathing line ranged from 2.7 to 3.5 deg for the four duct arrangements. They were as good as those experienced with a conventional warm air system in a house having a full basement and good insulation.

Floor surface temperatures were satisfactory for the duct arrangement in which the feeder ducts extended into the exposed corners of the floor. Where feeder ducts were not extended into the corner areas, floor surface temperatures tended to be low. In narrow sections of floor directly

over the feeder, floor temperatures exceeded 85F. In no case, did temperatures above the perimeter duct or in areas along the walls adjacent to the subfloor plenum exceed 120F.

The actual pressure losses from the warm air and return air duct systems were in reasonably good agreement with the calculated values.

Results indicated that reasonable values were obtained by following the practice of selecting the fuel input rate on the basis of the total calculated heat loss divided by the assumed bonnet efficiency.

Based on the results obtained with the four systems studied, the investigators recommended that such a system be designed so that feeder ducts extend into exposed corners of the floor, the total air flow distances from the subfloor plenum to the registers are relatively short, and relatively high air flow rates are maintained in all sections of the perimeter ducts.

### Influence of Gases on Heat Transfer

Gas is an Important Factor in the Thermal Conductivity of Most Insulating Materials is the title of a paper prepared by F. B. Rowley, professor emeritus, R. C. Jordan, professor and head, mechanical engineering department, C. E. Lund, professor and assistant director, Engineering Experiment Station, and R. M. Lander, professor and assistant director, Engineering Experiment Station, all of the University of Minnesota.

It describes special hot plate apparatus enclosed in a sealed chamber from which the air and gases could be exhausted. The paper reports on a number of tests made by this method to determine the conductivity of various types of materials.

The statement that heat is transferred through an insulating material by radiation, convection, and conduction, is based on the assumptions that this material has some open spaces between the solid structure and that those openings are filled with gas which will transfer some of the heat that would not be passed through if the gas were entirely eliminated from the space. While this portion of the heat is often classed as convected heat, in most cases the greater portion of it is transferred by conduction through the gas, and convection is a minor factor. Since it is not possible to evacuate all of the gas from the cells within the sample, the studies must be confined to a reduction of the gas pressure to the lowest possible value.

The prime purpose of this investigation was to study the part played by gases on the overall heat transfer of the material under various conditions. Samples were selected which would be typical of various types of materials and to study the thermal conductivity of the samples with gas within the pores at a reduced atmospheric pressure and with the gas eliminated to the fullest extent of the apparatus.

Since heat is transferred through a material by conduction through the solid portions, by radiation through the open spaces, and by any gas that is enclosed in the material, and since increasing the density of a given material changes its characteristics for heat flow by each of these three methods, there is no simple straight line relation between density and overall conductivity which will apply to all different materials.

Under normal conditions, the rate of heat transfer by conduction would be increased by increasing the density. The effect of density on the amount of heat transmitted through a sample by radiation will depend upon the relation between density and open cells within the material. If the relation should be such that an increase in density would merely decrease the relative sizes of the open cells and therefore increase their number per inch of thickness, the effect would be to increase the resistance to radiant heat per inch of thickness. However, if the change should be such that the cells were eliminated, the normal increase in the amount of heat transmitted by conduction might over-balance that which was eliminated by radiation.

A change in density will change the size and perhaps the number of gas cells within a material which will, in some instances, have a marked effect on the amount of heat transferred by the gas.

Transfer of heat by free convection results from the difference in density due to temperature difference. Reducing the density by lowering the pressure would therefore reduce the amount of heat transferred by convection.

The authors discuss the conductivity of insulating materials as affected by the quantity of air or gas contained in the material.

### Thermal Performance of Frame Walls

Data obtained as the result of a preliminary study of the effects of convection in insulated and uninsulated walls containing air spaces were presented in a paper on Thermal Performance of Frame Walls. The paper was prepared by G. O. Handegord, assistant research officer, Division of Building Research, National Research Council of Canada, and N. B. Hutcheon, professor of mechanical engineering, University of Saskatchewan, Canada.

The basic wall panel used in this study consisted of 3/8 inch plasterboard, 2-inch by 4-inch studding spaced 16 inches on centers, spruce shiplap sheathing, building paper and cedar siding. While only four different insulation forms were used, eight different wall constructions were studied. In all the walls tested in which the interior finish was exposed to an air space, the rate of heat flow into the wall decreased with increasing height.

As the result of this preliminary study, the investigators arrived at the following conclusions:

The convective action within air spaces in walls has a much greater influence on the temperature distribution and heat flow pattern than is usually assumed.

The variations in heat flow and temperature resulting from convection appear to be more pronounced in walls containing reflective insulation than in similar walls having normal surfaces.

Improper sealing of blanket type insulation, or reflective curtain insulation, installed so as to create multiple air spaces, may result in an increase in both vertical heat flow variation and in overall transmittance.

Presently accepted theory based on the assumption of unidirectional heat flow is entirely inadequate for calculation of temperatures in hollow walls.

The use of small heat flow meters to evaluate the overall transmittance of walls may lead to erroneous results unless a complete vertical transverse is taken.

*(To be concluded)*

# CATHODIC PROTECTION AGAINST CORROSION of Heating and Plumbing Equipment

T. W. REYNOLDS

Cathodic protection against corrosion of metals in contact with water or soil is a subject appealing to the heating and air conditioning engineer, for practically all of the equipment used in his design is built of metal. In addition to the usual buried pipes, there are various tanks liable to corrosion especially on underwater interior surfaces and soil-contacting exterior surfaces. Such tanks may contain hot or cold water for building supply, refrigerated or well water for air conditioning, or water from return condensation, blow-off, or flash of steam. Also to be considered are tanks with bottom interiors submerged in water, such as those used for oil storage and compressed air. Corrosion losses to American industry have been carefully and conservatively estimated by experts at about $6 billion per year. Shortened structure life, increased maintenance costs, and greater out of service time are but a few of the results of corrosion. Furthermore, in addition to dollar losses there is a great wastage of critical materials and human effort. Cathodic protection, now over 20 years in use, has saved some of this.

CORROSION engineers find it natural, more convenient, and more definite to use a word-saving technical terminology that confounds those who have but infrequent reference to the subject, or who have a desire to absorb as quickly as they read. Pertinent technical literature assumes the reader to be well acquainted with fundamentals and often even more than that, hence such literature is replete with words with which we may have been once more or less familiar but have since forgotten or recall vaguely. Anodes, cathodes, electrolytes, solution potential, hydrogen ion concentration, passivity, voltage to remote earth, and many other terms may be remote and foggy to the non-specialist. For such, better going may be had by reverting to fundamentals, which follow.

## Fundamentals

Anode and cathode are just a couple of Greek words meaning the up way and the down way, which hardly seems appropriate because electricity is not influenced by gravity. Most dictionaries refer to them as positive and negative terminals of a current source.

Electro, also from the Greek, gives us the word *electrolyte*, which is merely the water or soil through which electric current flows from anode to cathode. Liquids in chemical and food industries can also be electrolytes.

Flow of current is from the positive or higher potential (anode) through the electrolyte to the negative or lower potential (cathode), and from thence back to the metal. Plus and minus signs are shown (Fig. 1) to indicate the flow, the polarity of the external circuit, being, of course, exactly the opposite of the internal circuit.

The foregoing set up is a galvanic cell, flash light or corrosion battery, such as shown in Fig. 1, wherein the carbon is the cathode and the zinc shell the anode and therefore the corroding member. Earlier forms of galvanic batteries were zinc and copper plates piled up on one another and were therefore called a pile (not the atomic pile, however).

The corrosion of underground and under water metal surfaces is electro-chemical due to galvanic action, that is, it is the result of a flow of electric current caused by reaction between the metal surfaces and chemicals in the soil or water. As a general rule the current flow is caused by chemical change as noted, but conversely a flow of impressed current from the metal into the soil or water causes chemical change. In any event, it is natural for metals refined by man to return to their original forms as ores or compounds.

Corrosion is always at the anode and where the current enters the electrolyte. Metallic ions there released into solution result in rust and pitting. The anode is said to have a higher solution potential than the cathode, that is, the greater tendency to go into solution.

The flow of energy or current is called galvanic after Galvani who, when hanging dead frogs by copper hooks on an iron rack, noticed a twitching or contraction of the muscles of their legs. This was due to his accidental connection of certain nerves and muscles of the frogs in a metallic circuit. Galvani thereby discovered a property of electricity, but knew it not as such. He supposed a vital fluid passed from nerves to muscles. Volta, however, being concerned with the connecting metals, observed that contact of unlike metals, either direct or through an electrolyte, resulted in a flow of electricity.

Soil acts as an electrolyte for it contains some moisture, especially at pipe line depth, even though in some cases it may be considered dry to our sense of touch. A soil that is perfectly dry would not conduct electricity, but this is a rare phenomenon.

If a galvanic current is neutralized, overcome or stopped by an equal or greater flow of current in the opposite direction (as would result by introduction of auxiliary anodes having a higher potential), then the anodic areas of the metal to be protected become cathodic to the auxiliary anodes. All corrosion is then transferred to these auxiliaries. In this way we can fight corrosion with corrosion and do so merely by the sacrifice of some metal which is expendable. The opposing voltage is low, just enough to overcome the low voltage set up by dissimilar metals.

Before passing on it should be mentioned that ions are electrically charged atoms, becoming anions (anode ions) when negatively charged and therefore flowing towards the anode, while cations (cathode ions) are positively charged ions flowing towards the cathode. Electricity is conducted through the metals by electrons and through the water (electrolyte) by ions.

In Fig. 2, the chemical reactions which occur at the steel nail and silver coin when immersed in the electrolyte (water) cause a galvanic current to flow from nail to coin. The nail has the greater tendency to go into solution in the electrolyte, so the nail rusts and becomes the anode, the coin the cathode. The meter proves by indication that there is a flow of current. It also measures the amount of this flow, from which the amount of corrosion can be determined, or, if desired, the amount of current can be computed by measuring the amount of corrosion.

In Fig. 3, two nails are used to demonstrate how identical nails (electrodes) can be made unlike in solution potential when in an electrolyte. This is done by impress-

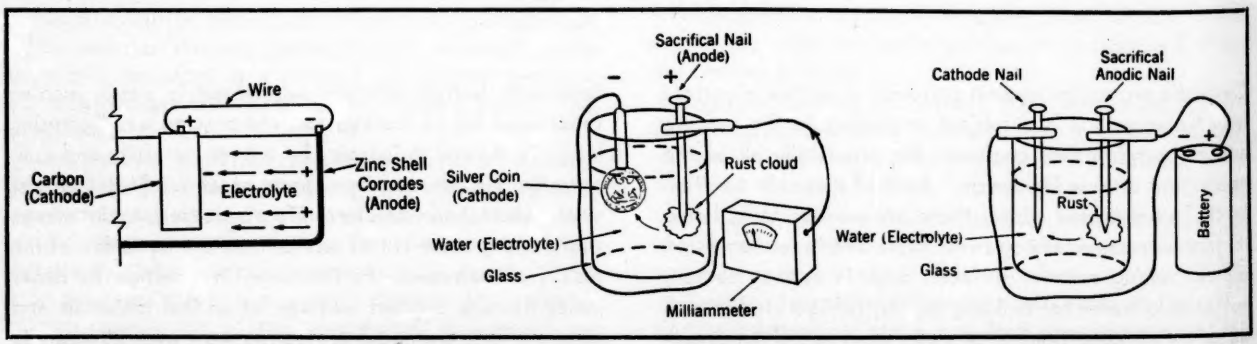



Fig. 1. (Left) Corrosion battery of galvanic cell. Fig. 2. (Center) Current flow from rusting nail demonstrated by meter. Fig. 3. (Right) Power of battery speeds up rust action.

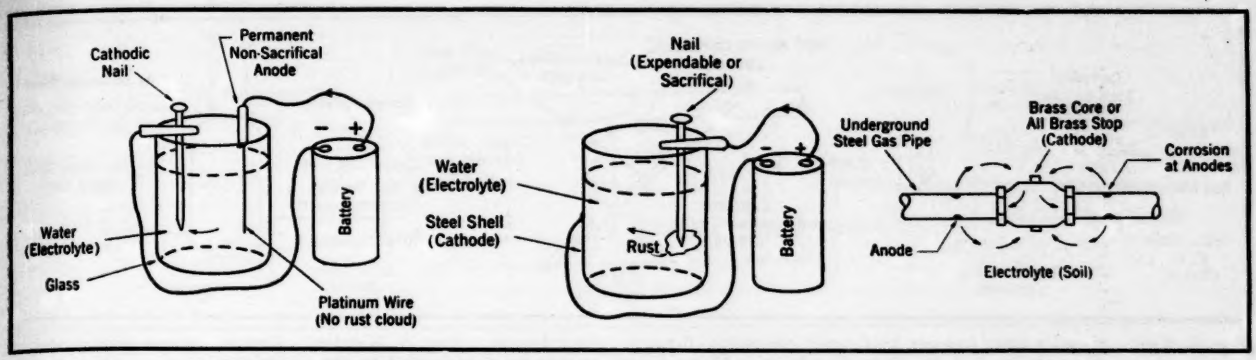



Fig. 4. (Left) Non-sacrifical anode to cathodically protect nail. Fig. 5. (Center) Diagram illustrating cathodic protection of steel shell. Fig. 6. (Right) Brass stop in underground steel main.

ing a current flow from the battery on both nails. Connecting to the positive pole of the battery causes the nail so connected to have the greater tendency to go into solution or rust, hence it becomes the anode. Accordingly, the other nail becomes the cathode and protected from rust. This nail is connected to the negative pole of the battery.

Oxygen released at the positive or anodic nail joins chemically with the iron to form oxide or rust. Hydrogen released at the negative or cathodic nail does not join chemically with the iron to rust, but rises as bubbles to the surface of the water. One nail is sacrificed to cathodically protect the other nail.

The battery further serves to make quickly visible by rust cloud the extent of corrosion it would otherwise take months to show. Observation of this action also quickens the interest and makes the entire subject less dull. One can visualize our structures crumbling before his eyes.

Now if this set up (Fig. 3) is altered slightly by substituting a bit of platinum wire (Fig. 4) for the anodic nail, the rust cloud disappears, because there is no longer any chemical union of oxygen with the metal of the anode. The nail cathode is cathodically protected by the higher potential impressed on the platinum, which in this case remains permanent and therefore non-sacrificial.

In Fig. 5, the jar has been changed from glass to steel. The steel shell (as in a water tank) contains dissimilarities in its own metal which would cause local anodes and cathodes to form galvanic batteries with the water and rust the steel shell were it not for the cathodic protection provided by the nail anode (if made big enough). In like manner a lone unprotected nail in a glass jar would rust because of its own dissimilarities.

In the many sketches* which follow, various conditions are illustrated whereby corrosive currents are set up, not only by dissimilar metals and dissimilar surface conditions of a ferrous metal, but also by dissimilarity of the electrolyte or soil, either in its kind, aeration or moisture content. Acidity, salt content, electrical conductivity, chemical properties and bacteria of soil are still other factors causing corrosion. Some corrosion engineers say that differential densities of oxygen, acid, or air can also produce anodic areas and corrosion.

Although such of the sketches as pertain only to applications do not show all kinds and sizes of equipment, yet they are sufficiently embracive to convey the main idea. Lack of illustrations for other applications does not mean that other applications are rarely made, but rather that data pertaining to them were not as readily available to the author at the time of writing.

The sketches are typical only for the situations and conditions described. The reader should not infer from the text and sketches that the given information can be applied directly by himself to his own particular problem. They are only for his guidance in understanding better the reports or proposals which may be set before him by the specialist on corrosion problems.

## Corrosion by Dissimilar Metals

In Fig. 6, the current leaves the steel pipe (anode) to enter the electrolyte (carrying metal with it), continues on to the brass stop (cathode) and returns by way of the metal to the anode.

The familiar galvanic cell is again demonstrated in Fig. 7 where two branch lines of dissimilar service and metal are but a short distance apart. Current enters the electrolyte (soil) from the cast iron water main, steel gas main and its service branch, taking metal with it. The electrical circuit is completed by return to the gas service line through the connected water heater. This galvanic circuit could be interrupted to stop corrosion by means of an insulating connection at the gas meter.

Service lines have relatively thin walls exposed to moisture and soil conditions normally more severe than those to which the mains are subjected. For such services, a magnesium anode is offered for cathodic protection. Some anodes come packaged with prepared chemical backfill and a connecting wire ready for field installation.

In Fig. 8, the return circuit could be broken by an insulating connection between the copper and steel pipes. Another such connection could be installed at the inlet to the gas meter to prevent galvanic interference from any other underground structures.

Fig. 9 shows many dissimilar metals is one assembly. The zinc on the galvanized pipe is anodic to steel pipe and is the strongest anode. Current will also flow from the galvanized tank surfaces to the copper dip tube and the brass drain valve. They will act one way if they are brass and another way if they are steel. There will be action between the steel tank and brass unions, also between the iron couplings and copper water outlet pipe.

Non-ferrous sprinkler heads in a sprinkler system provide another example of dissimilar metal usage. Corrosion may not occur, because the water in wet sprinkler systems is maintained without change, as in hot water heating

*Over half of these sketches are modified from originals presented by A. B. Lauderbaugh before the 43rd Annual Meeting, Canadian Gas Association in 1950. Mr. Lauderbaugh is Chief Engineer, The Manufacturers Light and Heat Co., Pittsburgh.

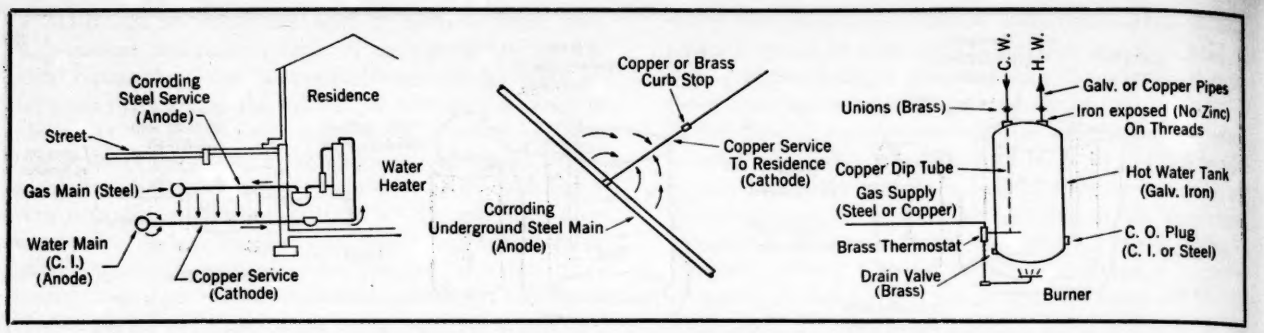



Fig. 7. (Left) Service lines (copper and steel) connected through water heater. Fig. 8. (Center) Copper service line connected to steel main. Fig. 9. (Right) Many dissimilar materials connected to hot water tank.

systems; or because, as in dry type sprinkler systems, there is only air in the pipes. Stagnant waters usually have low dissolved oxygen contents which fact is of assistance in retarding the corrosion rate, although the absence of dissolved oxygen does not mean that the pipes can not corrode.

### Corrosion by Dissimilar Surfaces

Fig. 6 to 9 illustrate the effect of dissimilar metals in a galvanic cell. Fig. 10 to 14 show the effect of dissimilarity in surface conditions.

The old pipe shown in Fig. 10, which normally would corrode and need the most protection because of age, is cathodically protected by its rusty surface at the expense of the new pipe. The new pipe being a short anode will be short on life and without doubt gone before the old. Return electrical circuit is through the metal of the pipe. Corrosive conditions would be eliminated if the new insertion were made with rusty pipe or a coated pipe to take the shine off of it.

Like the new pipe insertion in Fig. 10, the new main in Fig. 11 will probably go first, hence one often hears that steel pipe is not as good as it once was. The blame, however, lies in the galvanic cell caused by new pipe and a return circuit through the connecting cross over. Insulating flanges on this cross over would break the circuit and stop all this. It will be seen that the new anodic and old cathodic areas are about the same, providing both new and old pipes have the same diameter, so corrosion would be limited were it not for parallel mains of considerable length.

In Fig. 12, the bright threads next to the coupling become anodic and corrode. Conditions would not vary much whether the coupling is steel or wrought iron. In Fig. 13, anodes and rust are formed by breaks either in the mill scale or surface film, or by scratches from a pipe wrench or pipe tongs. Mill scale is the layer of oxide formed during hot fabrication of the pipe.

Fig. 14 shows tubercles formed by corrosion because of dissimilar surface conditions on a steel pipe or on a steel shell of a water tank. Local anodes and cathodes and resulting galvanic cell batteries occur at various points on the pipe, causing the anodic areas to dissolve in order to supply the current demanded by the cathodic areas and leaving behind the products of oxidation in mounds at the anodes. Return circuit is through the metal.

Tubercles sometimes end up in sealing off the pits, so that ions carrying electric current cannot get at the metal below. Cells then become inactive and corrosion ceases, unless someone or some action wipes the tubercles off. Some surface films give similar protection to metals which would otherwise react. Corrosion would be much more rapid and extensive were it not for protective films left by corrosion products.

It should be pointed out, however, that while rust scale may serve as a barrier to retard or stop corrosion at a given location, its very protection may set up galvanic currents from differential aeration due to limited access to oxygen. The corrosion may also be transferred to some other location, because corrosion attacks follow the path of least resistance. A simple analogy would be the case of a man eating plums off of your trees. You stop him and he goes to your neighbor's plum trees. However, if your neighbor makes it tougher for him than you do, he will be back to your plum trees.

As a further example, the insulating of a new pipe from an old pipe will prevent the corrosion interaction between the two pipes, but the change of equilibrium may be such as to cause an inactive pit to become active again. Therefore, while it is a good thing to flush out pipes to remove contaminating rust from the water, the removal of this rust may shift the corrosion attack back to some area which would otherwise remain protected by rust scale.

### Corrosion by Dissimilarities in the Soil

Fig. 15 to 19, incl., show the corrosive effect of galvanic cells from dissimilarities of and in the electrolyte or soil. In Fig. 15, anodic areas are formed on pipe in contact with clay strata through which the pipe passes from and to loamy soil. Clay is compact and poorly aerated. The longer the pipe line the more there will be of dissimilar soil conditions.

In Fig. 16, large contacting clods of clay in the backfill make anodic and rusty areas on the pipe. The backfill is a poor mix of various soils dug by hand from different depths. Machine ditching would have made a thorough mixture to provide many cells tending to neutralize one another and thereby slow up corrosion.

Dissimilar aeration of the soil is often the cause of corrosion. As illustrated in Fig. 17, cells have short paths around the circumference of the pipe. These short paths and relatively small anodic area along the narrow wetted bottom of the pipe cause rapid pitting at the bottom of the pipe. Fig. 18 is another example of dissimilar aeration. The wet ditch may be either anodic or cathodic, according to local conditions. Water in a creek area is usually of lower resistance than the surrounding soils. If so, the creek area will be anodic.

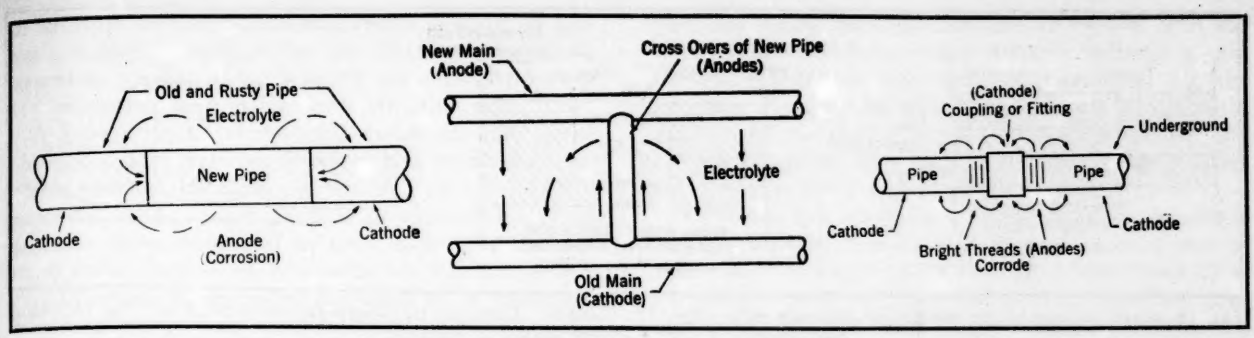



Fig. 10. (Left) Connecting new to old buried pipe corrodes the new. Fig. 11. (Center) New line buried parallel to old corrodes when connected. Fig. 12. (Right) Corrosion of exposed iron at threads.

In Fig. 19, the well line may be in a different soil from that of the well casing at the nearest point indicated as cathodic. The well line is the anode and corrodes in the case shown, but the situation could be reversed in some other case, since soils vary in kind. The well casing could be the anode and corrode in some other case. In like manner, the soils at various depths along the well casing can vary to form an anode and cathode on some point on the casing. The sketch shows an example which is not typical.

## Cathodic Protection Applied to Pipes

It was shown how the copper pipe in Fig. 7 does not rust because it is the cathode, hence any material can be preserved by reversing its condition from anodic to cathodic. This should not be done, as in Fig. 7, by sacrificing the steel pipe to save the copper pipe, but rather by sacrificing an auxiliary anode or anodes, as in Fig. 20. This sketch illustrates cathodic protection of pipe in its simplest form. Disregarding, for the moment, the rectifier and its connections, shown in broken line, the natural current caused by local galvanic cells of the metal protected is here reversed or prevented from entering the electroylte by making all surfaces of the pipe cathodic with respect to the sacrificial anode. Corrosion, it will be recalled, is only at the point where current enters the electrolyte or soil.

In Fig. 20, the anode, soil, and pipe represent in the same order the corroding outer zinc case of the battery, the electrolyte and the center cathode of the flash light battery. The anode is expendable. The wire shown is the return electrical circuit, the same as in the battery shown in Fig. 1.

Should the natural current be of insufficient density to prevent development of localized anodic areas on the surface of the pipe (like that shown in Fig. 14), the return circuit can be routed through a source of auxiliary d.c. power (the rectifier in Fig. 20) so that protection will be fully assured. In such case, of course, the return wire would not bridge the d.c. connection as it appears to do in the figure. Rather, the electrical situation would be similar to that shown in Fig. 3.

Fig. 21 illustrates cathodic protection of new pipe inserted between old pipes. Flow of current is continuous, indicating perpetual motion, were it not that the anode wears out leaving no material to react.

## Corrosion by Electrolysis

Some few remain who can recall when street transportation was solely by bus or horse trolley and how these were gradually supplanted by electric trolleys. The trolleys were more convenient, but their stray currents were found so inconvenient, causing a rapid corrosion of metals by an action known as electrolysis and first recognized about 43 years ago.

The trolley rails were the return electrical circuit from which the direct current was apt to stray direct to the current source or power house. On their way back, stray currents sometimes found it most convenient and less resistant than the soil to use the pipes, structures and other metals of property foreign to the railway. When near the power house the current again strayed and, entering the electrolyte (soil), it corroded the structure it left. Destructive as these stray currents were known to be in some cases, they were in other cases quite beneficial. Although we knew it not at the time, these powerful strays overcame many a weaker galvanic cell of natural or self corrosion.

Today the buses are back again and the trolleys are

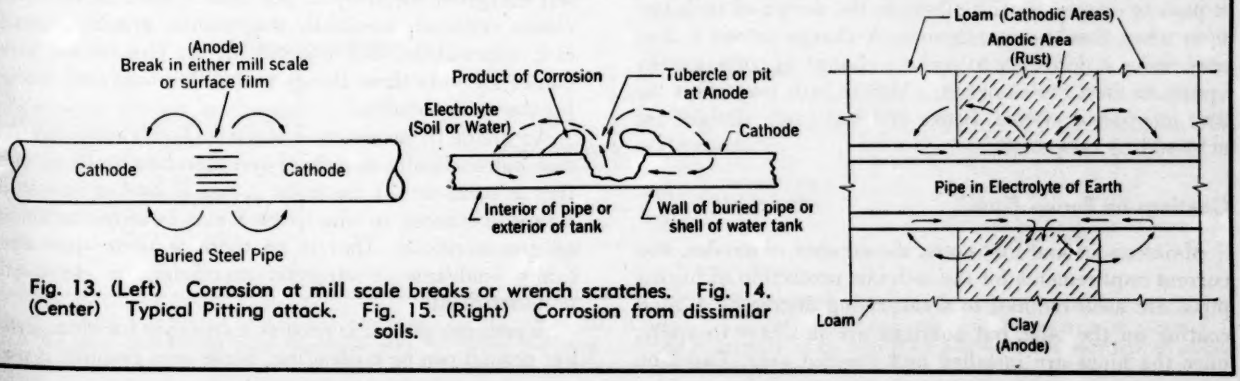



Fig. 13. (Left) Corrosion at mill scale breaks or wrench scratches. Fig. 14. (Center) Typical Pitting attack. Fig. 15. (Right) Corrosion from dissimilar soils.

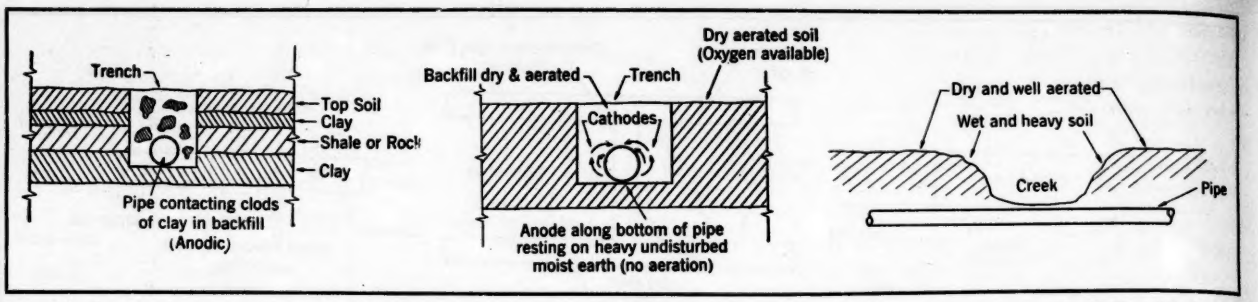



Fig. 16. (Left) Corrosion by mixture of different soils. Fig. 17. (Center) Corrosion by differential aeration of soil. Fig. 18. (Right) Small stream or ditch becomes anodic or cathodic.

gone together with their particular specialized corrosion troubles, but they have left behind or brought back to life the troubles (galvanic cells) they once made dormant by cathodic protection. Not all of the troubles are back, however, for the pipes have meanwhile rusted and lost some of their surface dissimilarities and galvanic cells, such as caused by pipe wrenches and pipe tongs.

Still, the fact remains that corrosion was only delayed to be brought back at a time when pipes are old and weaker and replacements much more costly. As a consequence, condemnation of ferrous pipe as now fabricated has increased. Because of troubles of the past with electrolysis, some engineers hesitated for a long time to install cathodic protection by deliberately introducing electricity into an underground piping system. It was not too easy to understand that there was a lot of good which could be developed out of the bad strays if properly engineered.

Just as street railway currents once strayed to pipes or other structures, so it is sometimes possible in congested areas for a cathodic current to stray on its way to the structure to be protected. Corrosion will then occur where the current leaves the interfering structure, unless such structure is connected to the protected structure by a wire drainage bond. The same thing was often done in the past by electric railways to protect the structures of others, thus avoiding the litigation which might otherwise occur.

In some cases of cathodic protection, it may be necessary to reduce the current in order to protect nearby structures from stray cathodic currents, even though this provides less protection for the structure for which the system is being designed. Currents are also less liable to stray when galvanic anodes are placed at more frequent intervals, especially so as their combined current is then less than when it comes from one central location. For similar reasons, anodes should be located near the structure to be protected.

Most owners of cathodic protection systems realize that it pays to cooperate with others in the design of such systems when these are contiguous. A change in one system may make it necessary to make a change in some nearby system to meet the situation, which in turn may affect the first mentioned system. Better and less costly designs are achieved by cooperation.

## Coatings on Buried Pipes

Maintenance and first costs, the number of anodes, and current requirements for the cathodic protection of buried pipes are each reduced to a surprising degree by a good coating on the pipe, but coatings are not easy to apply, once the pipes are installed and covered over. Based on experience, it has been found that coatings cannot be depended upon to give full protection against corrosion, but must be supplemented by Cathodic protection. One would be much concerned if in one mile of 3-inch buried pipe there were uncoated spots which in total were equal in area to 1 sq ft, yet this is only two hundredths of one percent of the pipe surface. The same percentage for a 24-inch pipe would be 8 sq ft.

Coatings should be properly engineered, applied and maintained and should be tested in the field. The coated pipe should be carefully handled and transported. New lengths of pipe later inserted should receive the same care. Coatings may deteriorate with time, or swell with moisture and shrink when drying. They are also subject to damage from stones and hard clods in the backfill, by soil movement with temperature changes and by being walked upon during installation. Any pin holes in the coating center corrosive action on minute areas, particularly where stray currents are encountered.

Cost of cathodic protection could be reduced in the case of coated pipe by protecting the pipe line only where needed. However, the current densities in well coated, reinforced and wrapped pipe are only one to two percent of the requirements for uncoated pipe, hence the cost of a survey to determine where the points are which need protection becomes disproportionately large. In the case of an uncoated pipe line, the cost of cathodic protection is so great that the cost of such a survey would be relatively small. Nevertheless, the complete coating of buried pipe is still desirable since it gives partial protection against stray currents. For this reason, coatings should be applied to new pipe lines in localities where cathodic protection systems are likely to be installed (or even possibly installed) at some future time.

## Types of Anodes

Anodes are referred to as galvanic, internally energized, self energized, electrolytic, permanent, ground, inert, corrosion resistant, insoluble, magnesium, graphite, sacrificial, expendable, and non-sacrificial. This is too many names for only three things and makes confused reading for the non-specialist.

An anode in its action is either (1) galvanic, in which case automatically sacrificial and therefore needs no mention as such, or (2) electrolytic, that is, having an outside source of current, in which case it may be either sacrificial or non-sacrificial. That is all there is to it—just three things—galvanic, electrolytic sacrificial, or electrolytic non-sacrificial.

Sometimes *ground* is used as a synonym for *electrolytic*, but ground can be misleading. Sometimes graphite is used

to designate electrolytic and magnesium to designate galvanic, simply because of the fact that on underground structures graphite is used mostly on electrolytic work and magnesium used mainly with galvanic work,

A non-sacrificial (electrolytic) anode can only be of chemically inert material, therefore it is permanent, corrosion resistant, insoluble and not used up. Obviously, a sacrificial anode (either galvanic or electrolytic) is expendable, being consumed or used up to save the protected metal. Such an anode must be one that is relatively easy to replace compared to the metal to be conserved. Sacrificial, rather than expendable, is the more popular term of the two.

Non-sacrificial (electrolytic) anodes depend for their energy upon some external direct current as usually rectified from AC power and impressed upon the cathodic protection system. The current is said to be impressed because it comes from a source other than the anode itself. Because of this, non-sacrificial anodes cannot be used as galvanic anodes. In the case of galvanic (sacrificial) anodes, the current is internally or self generated by the inherent characteristic of the anode when in combination with the metal object it protects and the electrolyte in which both the anode and the metal are immersed. In other words, galvanic anodes generate their own current due to the galvanic action set up by their naturally high solution potential when in an electrolyte.

Since in a galvanic cell the anode is consumed, one may wonder how cathodic protection can be obtained with an anode that is not consumed. The reason is that in the case of a permanent anode, such as platinum, protection is provided because direct current is forced from the anode by some outside power source. The chemicals which then form at the anode surface are unable to react with the metal of the anode and use it up.

The most prevalent chemical found at the anode is oxygen. Oxygen will react with magnesium, aluminum, iron, steel, copper, cast iron, wrought iron, zinc and the binder that holds graphite and carbon together in anode form. It will not react with graphite, carbon or platinum. Anodes of these last three mentioned materials become permanent anodes and cannot be used as galvanic anodes because they have no self energy.

Sacrificial anodes may be of zinc, magnesium and aluminum. Examples of non-sacrificial (electrolytic) anodes are carbon, graphite, platinum and lead. Such type of anodes must be used when current density requirements are greater than can be met by galvanic (self energized) anodes.

Strictly speaking, the only true non-sacrificial anode is platinum which does not combine chemically with the chemical products formed on its surfaces. Although graphite and carbon are also called non-sacrificial (in the sense that the graphite or carbon does not combine chemically), still the binder that is used to hold the graphite or carbon together does combine. This allows the graphite or carbon to slowly fall off of the anodes.

There are various degrees of sacrificial anodes. Magnesium and steel lose many pounds per ampere year of operation. Aluminum in the same time loses about 10 to 12 pounds while graphite and carbon (so-called non-sacrificial) lose very little (in the order of a fraction of a gram).

Voltage is usually the predominant factor in determining whether a galvanic or an electrolytic anode will be used. Galvanic anodes in sea water, which has a very low resistance, can generate large currents. In practise, one first determines or estimates the amount of current that will be required to protect a structure. Examination of the electrolyte reveals its resistance which can be translated into the amount of voltage needed to obtain the amount of current desired. Once the current required and electrolyte resistance are determined, it can then be computed whether it is more economical to use several small current sources, such as magnesium anodes, or one or a few large current sources, such as rectifier units and graphite carbon anodes. Of course, this process will be much less difficult in cases where some local factor becomes of such importance as to make the decision clear cut.

Galvanic anodes are generally unsuited for water tank protection because of their low voltage driving characteristics. They can be considered for such usage only where there is a favorable combination of the following factors: (1) low electrical resistance and high temperature of the electrolyte (water), (2) small area to be protected, (3) low current density requirements, and (4) no available nearby power source. These considerations have restricted galvanic anodes in water tank applications to residential hot water heaters and sea water installations. Over 15,000 large water storage tanks in the United States are cathodically protected. Almost all of these use impressed current and therefore have electrolytic anodes.

## Selection of Anode Materials

The selection of anode materials is usually based on economic considerations and to some extent upon the size and nature of the particular application. In the case of galvanic anodes, magnesium is the most popular anode material while some zinc and aluminum have been used,

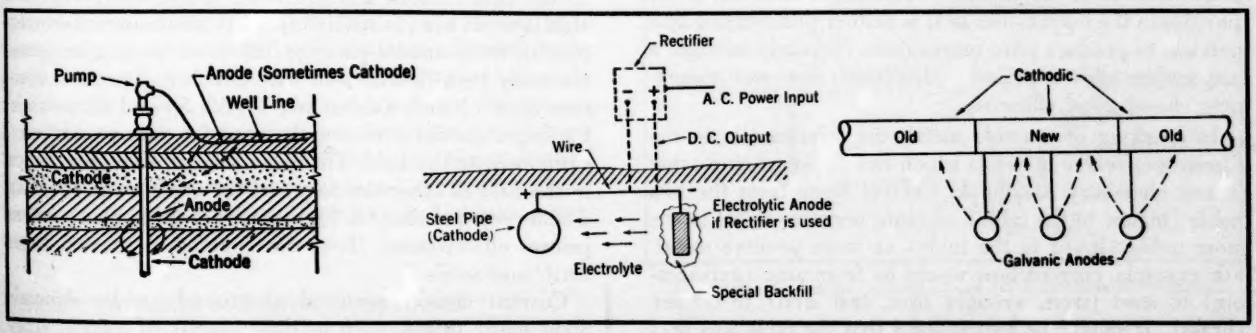



Fig. 19. (Left) Corrosion of well line and pump casing. Fig. 20. (Center) Cathodic protection of pipe. Note that if rectifier is used the wire connecting pipe to anode will not cross the lead wires as it appears to do here, but will have the rectifier in series. Fig. 21. (Right) Cathodic protection of pipes.

but the last mentioned material has been used only on an experimental basis.

These metals must be less noble than the structure to be protected. In practise they are less noble by quite a few tenths of a volt so that gas and atom films built up upon the anode and cathode surfaces by the current passage will not serve as a sufficient electrical barrier to prevent current flow. This is the present problem with aluminum for galvanic anodes. Although aluminum should work as a galvanic anode, the films built up upon the anode surface are such as to serve as a high enough resistance to prevent current flow.

In the case of water storage tanks, aluminum (although less noble than steel) is used, but only as an electrolytic anode as served by a rectifier unit. Aluminum is used in about 85 percent of large water storage tank installations, because of ease of installation (due to light weight) and lowest cost of metal per ampere year of system operation. It is also used because of its excellent current passing characteristics, as these result in low resistance of the cathodic protection circuit and low power consumption. Corrosion products from aluminum are colorless and tend to adhere to the anode. Graphite deteriorates at a slower rate than aluminum and will be more widely used as aluminum becomes more difficult to obtain. Objections, meanwhile, compared to aluminum, are greater weight, lesser strength and an anode binder, which in oxidizing, may cause expansion and parting of the main body.

Platinum, graphite, cast iron, steel and steel alloys, are sometimes used for anode construction in water storage tanks. Platinum does not need to be replaced as it does not deteriorate, but it is expensive and has poor current passing characteristics. The latter disadvantage limits its use to small water tanks containing a low resistance water where costs of power consumption are insignificant. The further limitation of expense makes it objectionable for use in any water tank liable to ice formations. Cast iron and steel alloys are inferior to aluminum and are generally unsatisfactory. Magnesium anodes have a high content of stored energy and a high solution potential. The resulting strong galvanic cell gives a good flow of current. They are now widely used for the protection of pipe lines and domestic water heaters.

In the case of water heaters the tank becomes a battery, its wall acting as the carbon or cathode and the rod or rods acting as the zinc or anode. The rods are sacrificed to protect the tank and are made flexible by sectionalizing with links for easy replacement where headroom is low. Available in various lengths.

Non-productive or local corrosion of the anode itself is detrimental to anode efficiency. This can be caused by impurities in the magnesium as it is neither possible nor economical to produce pure magnesium. Strangely enough, a magnesium alloy containing aluminum, zinc and manganese shows good efficiency.

In speaking of a noble metal, the reference is to the Electromotive Force Series which can be found in a table in any chemistry handbook. Current flows from the less noble (higher in the table) or more negative metal to the more noble (lower in the table) or more positive metal. For example, current flow would be from zinc (galvanizing) to steel (iron, wrought iron, cast iron) to copper (brass). It should be remembered that the table was prepared on the basis of immersion of the metal in a standard solution. However, the chemical reactions in different solutions may be such as to reverse the normal relationship of any two metals.

The greater the amount of current used the sooner anodes require replacement. Under favorable conditions this may be a matter of several years. The life of any anode system (except in water tanks where heavy ice formations may occur) is in general purely a matter of the current output of the anodes and the total weight of the anode material. The duration of life of anodes is therefore pre-determinable. There are only a few cases where this statement is not true. Life of underground cathodic protection systems is usually in the order of 4 to 10 years for galvanic anodes and 10 to 40 years for graphite anodes.

### Buried Anodes

Magnesium anodes for pipe line protection are constructed for ease in molding or forming. They are easy to handle and as easy to place in augered holes. Sometimes they are buried to a depth where the surrounding soil will retain enough moisture throughout the seasons, but the matter of soil depth is purely a local matter and can therefore vary quite a bit. Thus, they are buried shallow in soils of low resistance where these are non-freezing, but in freezing locations it is important that anodes be placed below the frost line because ice forms a highly resistant electrical barrier. Of course, on cultivated land areas anodes should be buried below plow depth.

Considering all factors, it may be briefly stated that magnesium anodes are buried to the depth which indicates lowest soil resistance below frost depth. Resistance readings at 10-ft depth are generally lower than on the earth surface, however soils differ radically throughout the country. Thus, in some cases favorable soil resistance has been found in such a thin stratum that it has been advisable to install the anodes horizontally.

### Backfill at Anodes

The usual earth around a buried anode does not have the proper chemical and electrical properties for best performances of the anode. Hence, it is necessary to condition the backfill with certain low cost chemicals which give less electrical resistance, a more effective yield of energy and a more uniform anode consumption to maintain the anode in one piece.

This can best be done by using anodes packaged with a backfill standardized or prepared to meet owners' specifications. Obviously, such anodes do not have to be centered in the hole when installed vertically, nor centered in the field backfill mixture when laid horizontally in a thin layer of low resistivity top soil. Various manufacturers furnish these anodes packaged in quick wetting moisture retaining backfill with lead wire attached. The most common sizes of such anodes are, 17, 32, 50 and 51 pounds. Packaged anodes eliminate the need for taking additional equipment to the field. They also save material and labor in the field as otherwise required for mixing and tamping a field-prepared backfill. Elimination of the human element insures effectiveness. Holes are augered to prevent loose earth and voids.

Current density required at ground anodes depends upon many things, such as dissimilarity of metals, stray currents, location of other nearby metal pipes or structures, and pipe coatings. It further depends upon the condition

of the soil as to temperature, electrical conductivity, moisture, chemicals in the soil and moisture, and variations of all these soil conditions with the seasons. Tamping of backfill lowers resistance and wetting it causes earlier functioning of the anode.

### Size of Buried Anodes

The required size of an anode will vary for different soils. Mere weight of anode does not offer the proper solution since weight only determines anode life. In some cases two to six or even more magnesium anodes might be required on a service line such as shown in Fig. 7. In other cases soil resistance may be so high that a rectifier system would be required.

Something new is a so-called magnesium ribbon laid parallel to a pipe line so as to give the line continuous protection. The lead wire at galvanic anodes is cathodically protected and needs insulation only to eliminate any waste of the current. In the case of electrolytic anodes the wire between the external power source and the ground anodes will be corroded unless entirely insulated.

### Cathodic Protection of Oil Storage Tanks

The cathodic protection of exterior soil contacting surfaces of steel oil storage tanks are shown in Fig. 22 and 23*. As a rule the requirements of a single tank can be met by using galvanic type anodes, in which case the anode is generally of magnesium. Several tanks requiring protection, when in the same area, often use electrolytic anodes of graphite (non-sacrificial). A transformer rectifier unit impresses the direct current from a.c. power. However, soil resistances and characteristics are the governing factors in determining whether anodes shall be galvanic or electrolytic. Furthermore, if the anodes are grouped together rather than distributed, more current will be required. In this event, the near tanks receive more current than they need in order to insure minimum protection to tanks more remote.

Municipal and other regulations usually require that buried oil storage tanks be well painted on their exteriors. In these regulations no mention is made of their interiors, because it is not easy to paint them, yet oil storage tanks in proper soil corrode only on the bottom inside.

Cathodic protection for interior protection of such tanks is not too practical at the present time, nor does it appear likely under the usual conditions. Corrosion, however, in oil tanks is usually limited to the interior surfaces of bottom and lower side plates where steel contacts water pumped in with the oil.

In such cases there are possibilities of cathodically protecting the interior underwater surfaces. Several such projects are now under way with sizable tanks, although experiments to date do not look too promising. Successful operation of such systems requires that certain minimum and maximum water depths be observed by the customer, but water and oil storage levels change too rapidly and oil tanks are not equipped with gauges to indicate water depth.

### Cathodic Protection of Water Storage Tanks

The usual application of cathodic protection for the submerged interior of a water storage tank is shown in Fig. 24. The electric current radiates in all directions from the anodes through the electrolyte (water) to make the interior wetted surfaces cathodic.

This eliminates all the little local anodes and cathodes that would otherwise exist and form galvanic cells due to variations in electric potential between different areas of the metal surface. The entire surface is now cathodic.

The metal to be protected is electrically connected to the negative terminal of a current, such as a generator or battery, or, as in the illustration, to a rectifier. The positive terminal of the rectifier is connected to the electrolytic anodes, in this case constructed of aluminum and therefore expendable or sacrificial.

Both installation and maintenance costs of cathodically protected water tanks vary according to the method, kind and number of anodes used, and the current density required for effective protection. The latter depends upon tank material and protective paints, if any, area of surface under water, the electrical resistance of the water and its corrosivity. Generally, however, the principal factor affecting costs depends upon the area to be protected.

It has been said that sea water has a high resistivity because of its corrosivity and would therefore require more anodes in order to keep down the voltage required. Actually, sea water has a low resistance and is corrosive mostly because of its high chlorine or chloride content. Resistivity as a gauge of corrosiveness is accordingly only a rough means of identification. For instance, dissolved oxygen which is highly important is not picked up by this method. It is a method that should only be applied to fresh water. This subject is still highly controversial among the experts, so it is only given brief mention here to complete the record.

Dissolved oxygen in water is objectionable because it combines with the hydrogen films which would otherwise protect the steel surfaces. The more an anode chemically reacts with the gas films on the anode surface, the less there will be of dissolved oxygen introduced into the water. Aluminum, therefore, produces only a slight amount of dissolved oxygen. Platinum, which does not combine, produces the maximum amount.

On the other hand, there is no type of anode that does not liberate dissolved oxygen to some degree. Furthermore, the oxygen liberated by anodes in a water tank is

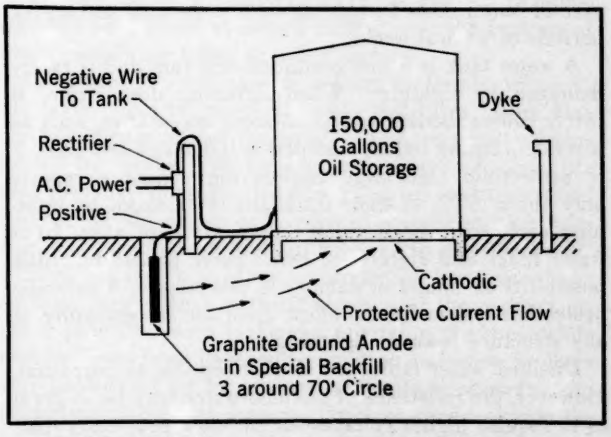



Fig. 22. Cathodic protection of tank bottom on ground.

*Fig. 22-23-24, Courtesy of the Harco Corporation. Fig. 22 is an example, not the correct way of protecting all such tanks.

more toward its center and not next to steel surfaces. Then, again, it is no problem to build up a hydrogen film faster than dissolved oxygen can remove it. All that is needed is a slight increase in the current output of the rectifier system, so as to increase the thickness of the hydrogen film across the steel surfaces.

The number of anodes required to protect a given shape or size of tank varies quite a bit in accordance with water resistivity. An installation in a 100,000 gallon elevated steel tank with an inside wetted area of approximately 3,000 sq ft usually requires only from three to nine anodes. A single anode is satisfactory in tanks of small diameter. The usual water tank on a railroad has a capacity of 100,000 gallons and generally requires four anodes, one in each quadrant. The tank shown in Fig. 24 has an unusually large capacity requiring 44 anodes, together with one long one in the riser bowl. This is on a separate circuit.

The location of interior pipes or obstructions and the areas of their additional surfaces to be protected must be taken into account for number and location of electrodes. Areas exposed at low water level should be considered, although sometimes said to be protected by the residual effect of cathodic protection where fluctuations in water levels are but normal. However, no water tank operates in accordance with a standard pattern and the water level may be down for quite some time. In any event, the cost of painting the area in question is negligible when other tank surfaces are painted. The electrodes should remain submerged regardless of water levels.

Upon first operation the voltage of the cathodic protective system is set up to quickly provide a protective film on the metal to be protected. The resulting change in local conditions may temporarily require even higher voltage until finally conditions are normalized and the protective film established. This may take from one to six months. Periodic inspection of cathodic equipment is advisable to check whether it is in operation, test fuses and switches, and record voltage and ampere readings.

Cathodic protection of all structures should preferably be constant. This, of course, is not possible where a continuous source of power is not available. Wind generators, sometimes used, must of necessity operate on an intermittent basis. Unfortunately, those who try to devise some method of operating a system on an intermittent basis end up in spending more in engineering expense than they save in power costs by turning their system off and on for periods of several weeks.

A water tank is a well grounded structure and is rarely damaged by lightning. When lightning does strike, it rarely causes damage except to some accessories, such as aircraft warning lights, obstruction lights and any cathodic protection. One large engineering company reports only about .05% of their installations damaged by lightning each year. High voltage lines are kept away from water tanks and rightly so, hence there is also but little possibility of danger or damage in this respect. A cathodic protection system has no effect upon the susceptibility of any structure towards lightning.

Distilled water tanks are also susceptible to corrosion. However, the resistance of distilled water may be so great as to require higher voltages for cathodic protection than are practical from an economy standpoint. In actual practice distilled waters have from 1 to 50 parts per million total dissolved solids, the precise amount depending upon the particular application by which the distilled water is obtained and the purpose for which it is used. The higher the total dissolved solids the easier it is to pass the necessary current for cathodic protection. A water of zero parts per million total dissolved solids would have an infinite resistance and prevent the passage of any protective current.

### Cathodic Protection Plus Paint

Cathodic protection can be applied and maintained without disturbance of the usual* structure. A water tank without cathodic protection may require complete interior painting once every four years, possibly spot painting between times. Painting delays the start of service from a newly erected tank and interrupts the service at periods of repainting thereafter. Cathodic protection is maintained at full efficiency regardless of time and location. The efficiency of paint protection lowers from the time it is put on and the protection it affords varies with the locality and the chemical nature of the water stored in the tank.

In some installations, railroads, for example, certain tanks actively used cannot be taken out of service even for a few hours without a most serious upset of routine. If finally taken out, the time of repainting will be long delayed. Meanwhile the tank corrodes. Since interior repainting time varies from four to fifteen days, a spare tank may eventually be added. This is advisable, although it does increase the amount of painting, as well as the amount of metal to corrode.

Interior painting involves tank drainage and drying, cleaning by hand or power wire brushing, hand scrapers, sand or emery paper, or by sand blast. As a rule, sand blasting is the most economical and effective method of removing old paint. Other methods of removing the old

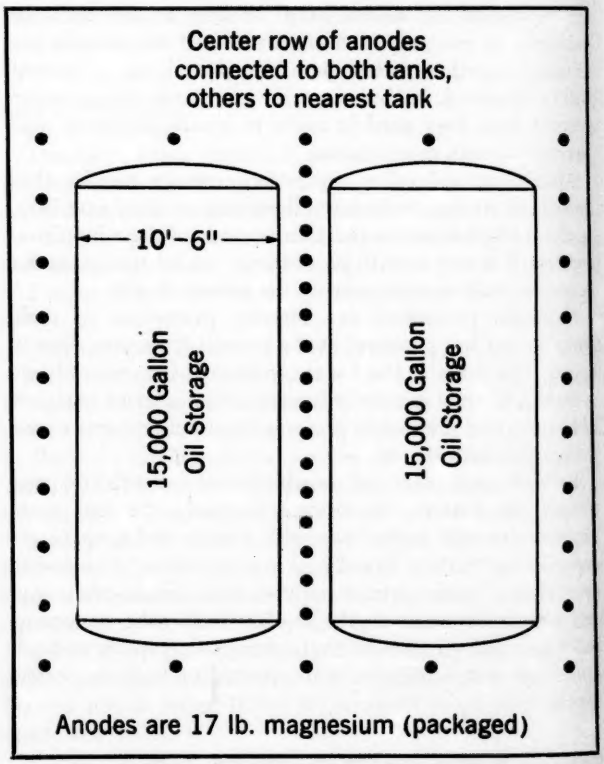



Fig. 23. Cathodic protection for buried oil tank exteriors.

*One exception would be a water tank under pressure. Drainage of pressure tank, however, would not be required.

paint require burning with a blow torch, oxacetylene torch, or paint (chemical) strippers. Sand blasting is a silicosis hazard and any solvents used for cleaning may be toxic, suffocating or inflammable. Ventilation is required in such cases.

The interior surfaces of a water storage tank above its high water level and those intermittently wetted should be painted, in fact in most cases all of the interior surfaces of the tank should be painted regardless of cathodic protection. Sole dependence upon painting for corrosion protection is, of course, not advisable, while sole dependence upon cathodic protection may in many cases entail an unreasonable cost. Cathodic protection does retard the frequency of painting applications and does offer more efficient protection. Elaborate paint coatings may be eliminated.

Paints on interior surfaces of water storage tanks act in the same way as coatings do for underground pipe lines. In each case the need for painting must be decided upon its own merits. A tank without a paint coating requires high amounts of current, the same as with an uncoated pipe line. On the other hand, with a small tank the difference between the amount of current required to protect the tank with or without a paint coating may be so slight as to justify economically sole reliance upon cathodic protection. In such cases, the interior of the tank could be left bare of any paint whatsoever. In large water storage tanks such as those of 1,000,000 gallons capacity, interior paint coatings would materially reduce both the amount of current required for cathodic protection and the cost of such a system.

### Rectifiers

Rectifiers of the older type are equipped with sulphide and copper oxide rectifier stacks. New units are being assembled with selenium rectifier stacks of the full wave bridge type. Selenium is the metal which is used to act as a one way valve. It has a high resistance to current of one polarity and a low resistance to current of the opposite polarity.

The purpose of these rectifiers is to supply direct current to the cathodic protection system. Alternating current is usually available, but it has changing polarity, whereas constant polarity is required to keep the tank or pipe in an electrically negative or cathodic condition. Since direct current is seldom supplied by utility lines, especially at the low voltages required, the rectifier unit is used both to change or rectify the alternating current to a one-direction (direct) current and to reduce the power.

### Cost of Corrosion

Competent authorities after some years of patient research state that the losses[1] by corrosion in the United States is about six billion dollars per year. How this figure or any figure could be obtained is an interesting subject in itself, but one that need not be supported herein, since there has been published a wealth of data on the subject[2].

Not all of these losses are preventable since metals corrode to some degree regardless of corrosion protection. Furthermore, there is a relatively slight offsetting cost for

[1]Of these losses, one billion dollars is the estimated saving which can be made by cathodic protection through reduction of corrosion on major oil, gas products, water and utility lines that are underground.

[2]For example, a good detailed analysis by Herbert H. Uhlig was presented before United Nations Sectional Meeting at Lake Success in 1949.

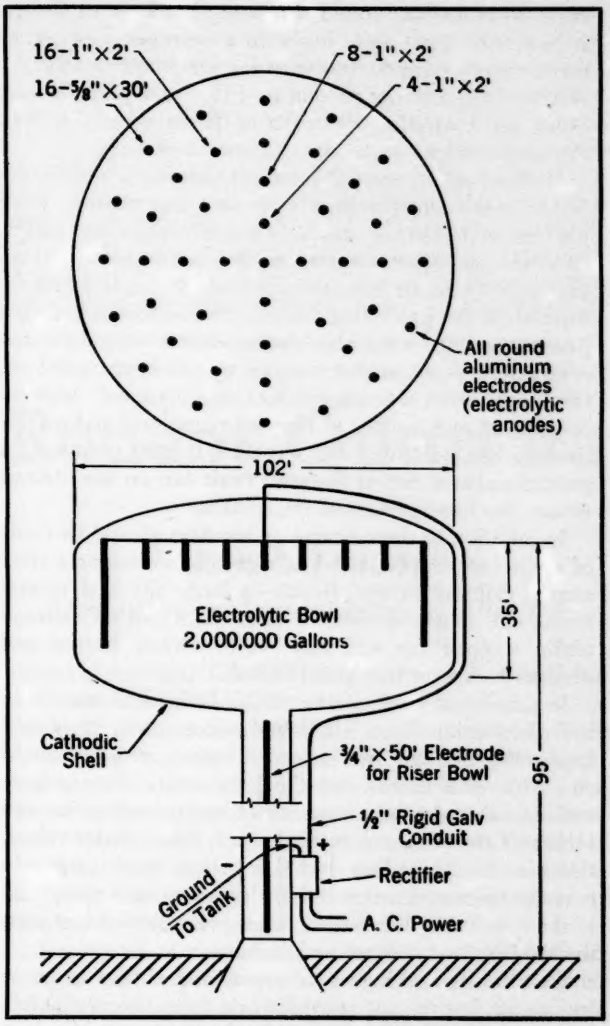



Fig. 24. Cathodic protection of water tank interior.

installation and maintenance of cathodic protection. On the other hand, full data on corrosion has not been obtainable, such as corrosion of tankers and oil wells and for equipment in railway, communications and other industries. Estimates are continually revised upwards as more data come in. Unfortunately, as yet, no practical way has been found to cathodically protect the interior of pipes containing water or other liquids.

Cost estimates and tons of critical materials, which in the main could be saved, are only the direct losses. One can not even guess at the sum of direct corrosion losses caused by breaks, long term leakage, fire, explosions, life and property damage, litigation, loss of customer good will, additional design of heavier equipment to offset corrosion and equipment or plant temporarily out of service.

Such outages are often accompanied by waste from spillage, impairment or contamination of the product, or other products, with inefficient operation the meanwhile and by losses from lessened production and sales. Spillage and leakage of oil or gas are particularly wasteful and hazardous in congested areas. Time required to locate the leaks or breaks is still another loss and delay. Furthermore, they sometimes occur when and where service is most required, that is, at peak loads and in congested areas. Pressures are higher at such times and places.

An example of waste and loss from corrosion is a gas

main 40 miles long found delivering but 10% of the gas it received. A public utility with a corroded unit out of service was paying $10,000 per day for power to a nearby system. In a housing project in 1950, four persons were killed and a dwelling damaged to the extent of $20,000; the cause—a gas pocket from a corroded main.

Mufflers on automobiles are not the only mufflers that fail by corrosion. It was only about a year since that 100 patrons of a Detroit theatre were overcome by carbon monoxide gas from a rusted muffler on a natural gas engine driving an air conditioning compressor. Others were injured in the panic that followed. Asbestos gaskets and line connections were also leaking due to expansion and contraction as the engine warmed up and later cooled off. Obviously, what was needed was an occasional check on conditions, or a muffler of heavier gauge steel and protective coating, or better still a muffler located outdoors. A general exhaust fan or induced draft fan on the exhaust would also have prevented the trouble.

In addition to these examples, mention should be made of a real catastrophe, a leak in a gas main crossing a river near a railroad bridge. Result—a large city and several towns out of gas service for three days and all railroad traffic stopped for one day while divers, barges and dredges took over to repair the leak.

In municipal water works, 90% of the metal used is in the distribution lines, all liable to corrosion. It is well known that leakage from corroded water mains has caused city wide shut downs and that rust accumulations have seriously decreased the capacity of pumps and mains and increased the pumping costs. In such cases, water velocities may be stepped up and this brings more oxygen to corrode the metal unless inhibiting chemicals are added to the water. Any increase in water pressure also increases the liability to breakage and leakage.

Water costs nothing at its source and is said to be as free as air, but the not so gentle rain from above contains a lot of things other than water. So it costs money not alone to secure, gather and store, but also to filter, sterilize, condition for taste and odor, and to pump. Service must be maintained, emergencies provided for and systems expanded, and, of course, there are administrative and accounting costs.

Allowance for corrosion in engineering design causes an increase in wall thickness of boiler and condenser tubes, tank shells and pipes, especially buried pipes. Sucker rods for oil wells are also made heavier than otherwise required and this entails more power for their operation and added expense when removed after breakage.

Costs chargeable to direct corrosion are increased by additional cost of nonferrous metals to avoid corrosion, a reasonable assumption that 50% of our paint production is used because of corrosion, by phosphate coatings as a base in paints and enamels, by rubber and plastic coatings, and the conditioning of boiler and other water, as well as by many other factors.

Records of the Federal Public Housing Authority maintained for five years at widely scattered housing projects show hot water tank replacements of from 10 to 25%. Massachusetts Institute of Technology reports an annual cost to the United States of forty million dollars for corroded water mains. Without doubt much of the pipe corrosion was caused by the use of used iron pipe and war quality galvanized pipe during periods of material shortages. Some of this material went into so-called temporary war plants, which plants, however, were in many cases sold and became permanently occupied structures.

Cathodic protection is but one way of conserving metals. However, if further employed to effect an improvement of only 1%, the annual saving in this country would be thousands of tons in materials and around six million in dollars. In many cases, cathodic protection would allow the use of thinner wall pipe. Oil and natural gas pipe lines could have wall thicknesses reduced 20 to 35% which would save steel, allow work to proceed during periods of pipe shortages, and provide larger internal pipe diameters serving to increase pipe capacities by 5%. Based on the total mileage of pipe in this country, the percentage increase in capacity would be equal to 50,000 miles of pipe.

Many of the larger industrial plants duplicate their large main water and other services and further provide additional tanks and other standby equipment, all as an insurance against shut downs. Spare parts are also kept on hand for equipment as well as pipe. All these duplications and spare parts increase the amount of corrosion.

Cathodic protection is a cheap insurance against shut downs and loss of fire protection in the case of sprinkler tanks, and eliminates the need for liability insurance against corrosion affecting personal, product or other property damage. It lowers maintenance costs and depreciation rates and avoids replacement costs for frequent renewals. As materials age, cathodic protection is more needed and becomes of greater value, particularly in congested areas where damage may be greatest and where a lot of other things have to be moved for replacement of corroded equipment. Cathodic protection does change the leakage rate from a constant rise to a constant decrease.

In the replacement of a water tank there may be many other things that must also be taken down or renewed, such as exterior or attached metals not subject to appreciable corrosion. Non-metals like wood platforms may also be sacrificed, the value of a newly painted tank exterior lost, and then there is the cost of reconnecting the tank with piping.

## Where Further Data may be Obtained

### Rectifiers

General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh, Pa.

### Aluminum Anodes

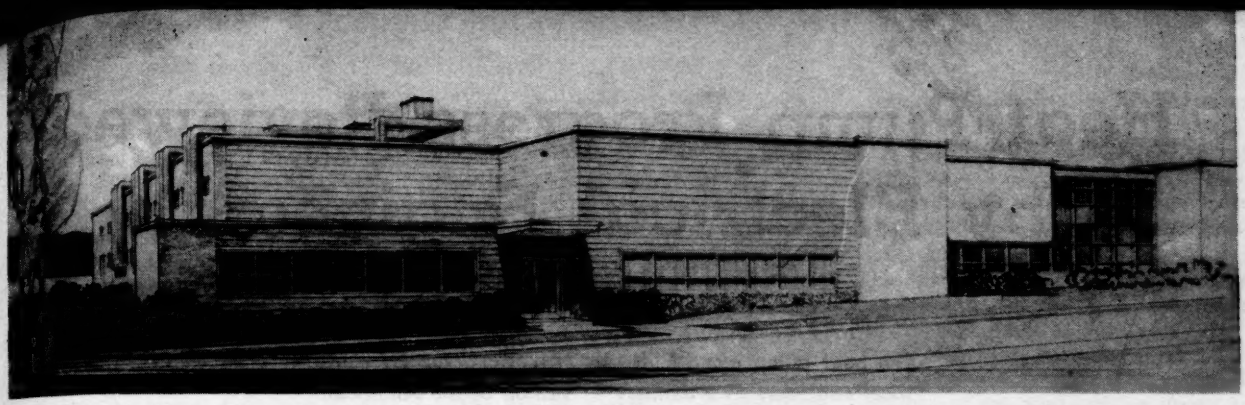
Aluminum Co. of America, 801 Gulf Building, Pittsburgh 19, Pa.

### Magnesium Anodes

Federated Metals Division, American and Refining Co., 120 Broadway, New York 5, N. Y.
Dowell, Inc., Tulsa, Okla.
Apex Smelting Co., 2537 West Taylor St., Chicago, Ill.
Standard Magnesium Co., Tulsa, Okla.
The Harco Corp., Cleveland 28, Ohio (Mr. Russell J. Stambaugh of this corporation has been most helpful in supplying information and literature necessary to the preparation of this manuscript.)
Electro Rust Proofing Corp., Belleville 9, N. Y.

### Other Data

The Corrosion Handbook by Herbert H. Uhlig, Ph.D, Associate Professor of Metallurgy (in charge of corrosion laboratory), Massachusetts Institute of Technology. A very thorough and voluminous handbook sponsored by The Electrochemical Society, Inc., 1948, $12.00.
The Fundamentals of Galvanic Corrosion by A. B. Lauderbaugh, Chief Gas Engineer, The Manufacturers Light and Heat Co., Pittsburgh, Pa.
A report of the Correlating Committee on Catholic Protection, National Association of Corrosion Engineers, 919 Milan Building, Houston 2, Texas, 50 cents.



Architect's (York & Sawyer) sketch of Brookhaven Biology Laboratory Extension which will house experimental animals.

# Air Conditioning Rodent Quarters

JOHN M. RUDDY

Brookhaven National Laboratory, Upton, L. I., New York

PRELIMINARY mechanical design for the new million-dollar Brookhaven National Laboratory Biology Laboratory extension (now under construction) revealed that there were inadequate design criteria to effectively engineer the ventilating and air conditioning systems for the rodent (rats and mice) rooms planned for the new section of the building. The required data were obtained from medical and biological literature, through the combined effort of Brookhaven medical and biological staff research scientists and architectural engineers. After careful study, the following design criteria for year-'round air conditioning were established as the most satisfactory health and breeding condition for rats and mice.

The temperature of the rooms, during the winter, should be maintainable at 80F plus or minus two degrees; and a drop to a minimum of 75F, over a period of not more than four hours in any one day may be allowed, when the *actual* outside conditions are more severe than the outside *design* conditions. During the summer, the temperature of the rooms should be maintainable at 72F plus or minus two degrees; and a fluctuation from 78F maximum to 72F may be allowed over a period of not less than three hours and for not more than once in each day of four consecutive days and only when the *actual* outside conditions exceed the outside *design* conditions.

The following table gives the heat load, latent and sensible, for adult rats and mice of average weight.

| | Heat Gain in Btu per Hour | | |
|---|---|---|---|
| Animal | Latent | | Sensible |
| | Quiet | Active | |
| Rat | 2.25 | 6.00 | 3.00 |
| Mouse | 0.50 | 1.32 | 0.66 |

Rats and mice should be considered as 95% active from 6 p.m. to 2 a.m. and comparatively quiet for the remainder of the twenty-four hour daily cycle. These animals are not particularly sensitive to humidity changes, as far as is known, and will do well with the standard humidity conditions of comfort air conditioning: 50% R.H. plus or minus 10% or dryer; i.e. 20 to 60% R.H.

Rats and mice are sensitive to drafts, therefore air movement should be kept below 35 fpm to prevent respiratory infections and other harmful effects. In addition, the dust in the air supply should be reduced to, and maintained at less than one-half the concentration allowed for human comfort air conditioning. One hundred percent fresh air is recommended, but if any recirculated air is to be used it should be passed through the main filters before it is recirculated. The main filters should be the best of activated carbon filters to control odors and bacteria. Recirculated air should also be filtered through a roughing filter as it leaves each individual animal room, to catch hair and other gross foreign matter before it reaches the ducts or main filter.

An important consideration is the protection of these exceptionally expensive animal colonies from the harmful effects of mechanical failures and power outages. These colonies may represent an investment of years of experimental work, the breeding of many generations before the desired research results can be obtained. Obviously, this could mean that the loss of a colony may invalidate years of research. The minimum protection against mechanical and electrical failure should be an alarm system to indicate when the design conditions of the animal quarters are not being met. This alarm should indicate, at a central point in the building, audibly and visually, exactly where the difficulty is; and should automatically ring an alarm, during the night and over weekends, at some point where there is twenty-four hour personnel coverage as this is when troubles usually arise. There should also be enough emergency power to run the air handling controls and refrigeration for the animal rooms, together with a multi-machine (at least three) refrigeration arrangement that will allow the demand to be satisfied by any one of three or more refrigeration compressor units. Some equipment, such as fan motors and circulating pumps, should be in duplicate.

All of the foregoing information represents an abstract of the special primary considerations for this type of facility as they affect air conditioning design, and it is not intended to be all inclusive. The detailed responsibility of gathering and co-ordinating data from the scientific people involved rested with George Ritzert and Joseph Rorick, mechanical engineers of the Architectural Engineering Group.

# Heat Pump Progress Reviewed by Electrical Engineers

**The heat pump came in for its annual checkup by electrical engineers at a January 21 session of the American Institute of Electrical Engineers in New York. Five conference papers were presented; one on a compression-type (heat pump) water heater, three on current investigations of residential heat pumps using earth as a heat source, and one on a new, commercially developed, packaged, air-to-air unit.**

## Experiences with Compression-Type Water Heater

M. S. OLDACRE
Utilities Research Commission, Chicago, Ill.

This paper gives the results of experimental work on three different compression-type water heaters under actual service conditions in the home as well as the results of some laboratory tests which were performed to provide a basis for rating the units. Details of the development program and of the units themselves are omitted as it is believed that the results obtained are of primary interest.

The name, compression-type water heater, seems more descriptive of its use and may avoid confusion with other types of heat pump installations.

SOMEWHAT over five years ago the group with which the writer is associated concluded that the compression-type water heater for domestic service had some very desirable characteristics for both the home owner and the utility supplying the electric service.

For the home owner the unit can supply hot water at a low operating cost; it can provide air conditioning for one room in hot weather; it acts as a dehumidifier for basements, reducing damage from dampness and speeding the drying of clothes. These added functions largely or completely offset the higher first cost of this type of heater compared with other water heaters. Also, the power demand is low enough that the water heater need not be limited to controlled service.

To the utility there is the advantage of very low demand with the consequent lower cost of the distribution system, and the elimination of controlled metering equipment that may be used for some of the high wattage resistance-type heaters. It is expected that the load factor of the heater will be relatively high.

### Development Program

A compression-type water heater was designed by Utilities Research Commission about four years ago in a form suitable for experimental purposes, that is, a "bread-board" layout. The heat source is the air surrounding the heater.

After tests in the laboratory, the unit was installed in the home of a member of the investigating group. There was already a standard electric resistance-type heater in his home, and arrangements were made so that each heater could be used alternately to obtain comparable test results.

Results were satisfactory, and the compression-type unit was remodeled to incorporate improvements that were indicated by the test. The second unit has been installed in the same home as before and several months experience has been obtained, but it is still under test.

At about the same time that tests were completed on the first experimental unit, pilot models of a commercially-designed unit became available. One unit was purchased and installed in the home in place of the first experimental heater. After satisfactory operation under quite detailed test conditions, it was moved to another home where the size of the family and living conditions were different.

The first experimental heater consisted of an 80-gallon cylindrical steel water tank, 60 inches high, containing a copper condensing coil; a 1/3-hp compressor, belt-driven by a ½-hp single-phase motor; a thermal expansion valve, and a finned-coil evaporator. The tank was covered with three inches of rockwool insulation. Freon 12 was used as the refrigerant. It was considered that the unit would have a nominal capacity of 60 gallons.

After completing tests on the first heater, the unit was rebuilt especially to provide a different condensing coil arrangement. The new tank, insulation, and jacket are standard parts of a 67-gallon electric resistance heater with heating elements omitted. A condensing coil of ½-inch O.D. copper tubing is wound around the lower half of the tank. The evaporator is a finned coil. The motor, compressor, etc., from the first model were assembled in one unit for connection to the condenser and tank.

The water heater that was purchased was one of a pilot group of 27 units. It is completely self-contained. There is a 53-gallon storage tank with a 1/3-horsepower hermetically-sealed compressor, evaporator, and other accessories mounted on top of the tank. Air, which supplies the heat to the evaporator, is drawn in through the openings near the top of the unit and discharged through the top by a small motor-driven propeller-type fan.

### Tests

Laboratory tests were made in accordance with the NEMA and EEI schedule of water delivery or draw-off. This calls for the draw-off of the specified capacity of the heater between 6:30 a.m. and 10:30 p.m. at designated rates of withdrawal during various periods of time.

It was soon found that the first model heater was able to deliver more hot water per day than the 60 gallons of nominal capacity. The recovery rate was high enough that the nominal rating should be considered 90 gallons; that is, more rather than less than the actual capacity of the tank. The overall coefficient of performance was 2.82.

Experience over about a year's time showed that the heater could provide all the hot water needed by a family of four which included three adults and a teen-aged boy. Basement walls and articles in the basement remained free from condensation usually occurring during warm humid summer weather. Also, in rainy spring and fall weather, when laundry was hung in the basement, it was found that it would dry overnight instead of requiring the usual two to three days.

In the year's time mentioned, the compression heater was used alternately with an 86-gallon resistance-type heater. The compression heater delivered 10.52 gallons per kwh as against 4.50 gallons per kwh for the resistance heater.

When the commercially-built heater was received, some tests were made in the laboratory. It was then installed in place of the experimental heater. Contacts were added to the water meter so that the number of quarts of water used in each five-minute period were recorded as well as running time, electric input, and water temperatures. The Btu output data for each five minutes when water was drawn was totaled for each day and the C.O.P. calculated.

The day by day results of operation between May 26, 1950 and August 1, 1950 are summarized as follows:

| | |
|---|---|
| Duration of test | 60 days |
| Water used, total | 3346 gallons |
| Electrical input | 282 kwh |
| Kwh per gallon | 0.0843 |
| Gallons per kwhr. | 11.87 |
| Heat output | 2,107,230 Btu |
| Water used per day, range | 27-98 gallons |
| Water used per day, average | 55.8 gallons |
| C.O.P. for 60 days | 2.19 |
| Aver. temp. difference (inlet-outlet) | 76F |
| Maximum water temperature | 142-147F |
| Load factor | 35% |

The heater was then moved to another home of three adults and a twelve-year-old boy, where equally satisfactory results are being obtained.

The second experimental heater was installed as a replacement for the commercially-built unit and has been under test with the same test equipment. However, the average use of water per day has decreased to 47 gallons as there were only three instead of four people at home most of the time. The C.O.P. for a 32-day run was 1.93.

Test data show that the overall efficiency of the machines, as shown by the performance factor or C.O.P., was greatly affected by the rate of usage of water. This is true of any heater as there are continuous standby losses due to radiation from the tank, etc., that are a greater portion of the total input as the usage decreases.

### Discussion of Results

Experience to date indicates that the compression-type water heater is satisfactory for the purposes and has the advantages for the user and utility stated at the beginning of this paper. The load factor of 35% and low demand of 600 to 800 watts is quite desirable.

The actual operating experiences indicated that the extraction of heat from the air in the basement during the house heating season had no noticeable effect on the cost of heating the home and there was no noticeable decrease in basement temperature.

---

# Home Heating and Cooling from Earth

Results of a two-year experiment on heating and cooling two Philadelphia homes by means of electrically operated heat pumps using earth as a heat source and sink, were reviewed by engineers from the Philadelphia Electric Co.

IN three technical papers[1], the authors concluded that the use of heat pumps is feasible, but several problems must be solved before homes can be heated or cooled in economical competition with more conventional methods.

The conclusions were drawn in the following papers: Installation and Operating Experience, by J. H. Harlow and G. E. Klapper; Earth as a Heat Source, by A. H. Kidder and J. H. Neher; and Suggested Possibilities for Practical Applications, by Constantine Bary.

Mr. Harlow and Mr. Klapper said the two experimental heat pumps performed effectively their task of providing year-round comfort in the home; occupants of both houses expressed full satisfaction with the heating and cooling effects, considering their experimental nature. The earth, they added, provided a reliable heat source and heat sink during the years of heat pump operation, including the periods of the highest heating and cooling requirements.

They noted, however, that substantial improvements must be made in the mechanical design, construction and assembly of the heat pumps if they are to obtain wide commercial acceptance as to the reliability of their operation, and economy of performance.

Mr. Kidder and Mr. Neher concluded that the earth is an entirely practical and reliable source of heat for the heat pump. It is an equally practical heat sink, but in summer has a lower heat transfer coefficient, requiring a longer coil for equal transfer. The heat withdrawn is completely restored by the end of an annual cycle, thus permitting the continuous use of a system without loss of efficiency.

Mr. Bary suggested that a system of heat storage used in conjunction with the heat pump would both reduce the required size of equipment and increase the annual load factor thus improving the competitive position of both first cost and operating cost of this type of system.

[1] These three papers are being considered for publication in AIEE transactions.

# A New Packaged Heat Pump

**H. G. FIFIELD and C. I. BACHELLER**
General Electric Co., Bloomfield, N. J.

A new heat pump, now entering the mass-production stage of development, provides automatic heating in winter, cooling and drying in summer, air filtering, circulating, and ventilating electrically with one completely packaged piece of equipment.

THE heat pump is simply a refrigeration system so arranged that advantage may be taken either of the cooling characteristics of the refrigerant evaporator or the heat dissipation from the condenser. To accomplish the heating or cooling of a building, a refrigeration circuit must be provided so that when heating is required, heat is brought into the building from a coil operating as a condenser, and when cooling is called for, the heat is removed through a coil operating as an evaporator.

The coil operating as an evaporator in the winter and as a condenser during the summer can be located in any heat source (which, of course, is a heat sink in the cooling season). Three of these presently in use are: earth, well water, and outdoor air; each having inherent advantages and disadvantages. The temperature of the source directly affects the efficiency and resulting economy of the unit.

Ground coils may be employed, but have practical limitations for use with packaged heat pumps. In addition to the expense of installing a ground coil, there are so many variables (such as soil composition and moisture content) involved in using the ground as a heat source that each ground coil would have to be individually engineered with reference to a detailed study of soil conditions, in the exact site of the coil.

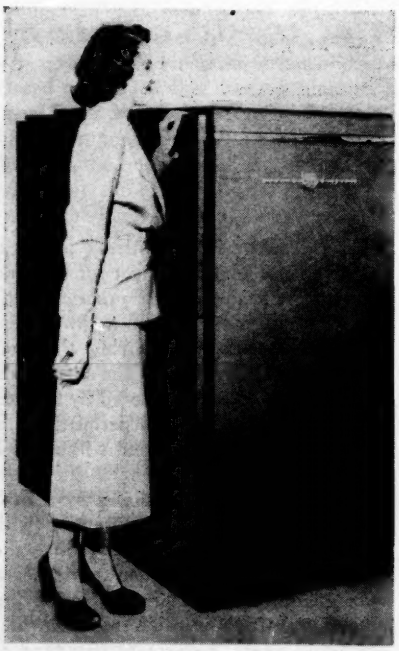


Fig. 1. 3-hp packaged heat pump.

Well water may be a good heat source since its temperature is fairly constant throughout the year and is generally high enough for economical heat pump operation. However, in many sections ideally suited for heat pump application, ground water is not readily available, and the high cost of providing a well of sufficient capacity and maximum reliability may be prohibitive. In the event a deep well is used, considerable power may be consumed in pumping the water required by the heat pump.

The heat source which seems to be most favorable for packaged units from an over-all standpoint is the atmosphere. The prime advantages are that air is universally available, is easy to pump, and is relatively predictable. Very accurate weather data have been compiled in this country for many years and can be used in the design and application of heat pumps using air as the heat source. Five years of experimental and field work by the General Electric Company with units using air have proved the practicability of this heat source. Air has the disadvantage that heat delivery is lowest when the outdoor temperature is low. This problem and its possible solutions will be discussed in more detail later.

The heat pump described in this article and shown in Fig. 1 and 2 has been designed primarily for residences and small commercial establishments, and utilizes air as a heat source. Field installations from Rhode Island to California have provided a vast accumulation of data on which the design was based.

Design objectives were: Automatic control, high efficiency, no more than routine maintenance, factory assembly to keep installation costs down, minimum cost and physical size, easy access to all components, and quiet operation.

## Design Problems

To obtain complete automatic control, a heat pump must be capable of changing from heating to cooling or vice versa at the command of a thermostat located in the conditioned space. In an air-to-air heat pump there are two basic systems that can be employed to accomplish this. One changes the refrigerant flow so that each coil functions, at different times, as either an evaporator or a condenser. The other system controls the air flow, so that in summer the air from the conditioned space goes over the evaporator and in winter over the condenser.

Diagrammatically, controlling the air flow appears simpler, since the only components necessary for changing the cycle are sufficient dampers to direct the air over the proper coil. However, this method has one big disadvantage in that the heat transfer surfaces cannot be utilized most efficiently. To obtain the maximum amount of heat from low temperature air during the heating cycle, the evaporator should be large and the condenser can be small. However, during the cooling cycle, when the heat pump is required to reject heat to high outdoor temperatures, for most efficient operation the condenser should be considerably larger than the evaporator. This is impossible to attain by controlling the air flow, since, by definition, the functions of the two coils remain the same during both the heating and cooling cycles. Because of this and the fact that large dampers present a serious heat transfer and air leakage problem, changing cycles on the heat pump under discussion is accomplished by controlling the refrigerant flow.

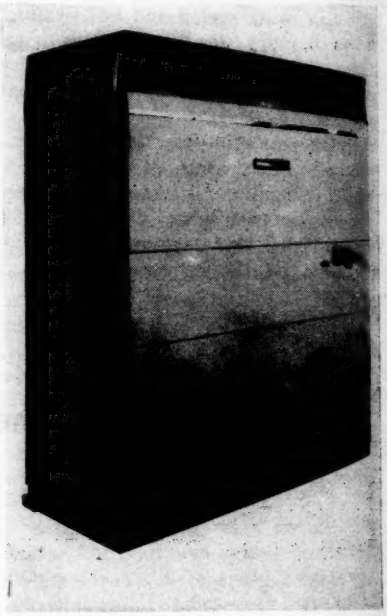


Fig. 2. 5-hp packaged heat pump, showing air distributor mounted at top of unit for in-space application.

The refrigerant circuit that was adopted, shown in Fig. 3, employs two three-way solenoid valves for changing cycles, one in the compressor suction

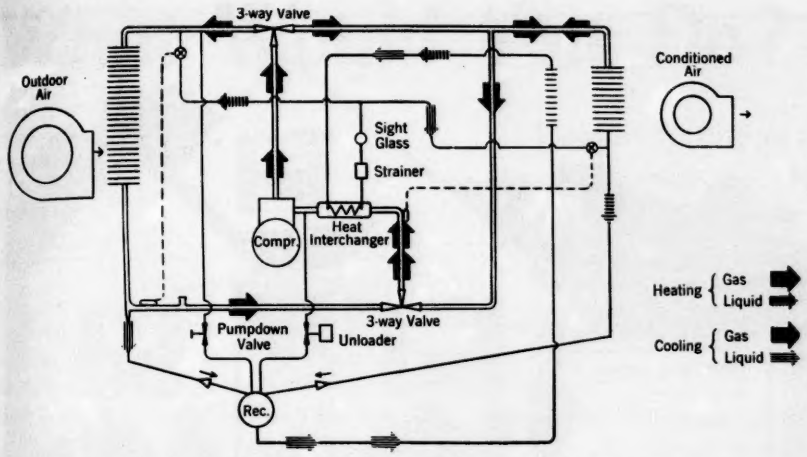



Fig. 3. Schematic diagram of G. E. heat pump refrigeration circuit.

line and the other on the compressor discharge. These valves are extremely simple and designed for trouble-free operation. They do not embody any complex pilot system, are direct acting, and close in the direction of flow. The pressure difference in the system maintains the valves in position so that power may be removed from the solenoids immediately after changing from heating to cooling.

Since the valves are direct acting, it is desirable in order to reduce solenoid requirements, to equalize the high and low side refrigerant pressures when changing cycles. This unloading is done by a small solenoid valve located in a line between the high and low pressure sides of the system, and actuated by the electrical control circuit. Between successive heating or cooling cycles the valves are not required to operate so there is no necessity for the system to unload. To prevent this unloading, a relay is incorporated in the control circuit which enables the heat pump to "remember" on which cycle it was last operating.

When the thermostat calls for cooling, one of the two coils used on the relay pulls the contacts into the "cooling" position where they are held mechanically until the other coil is energized by a thermostat signal for heating. A pressure difference switch sensing the differential between head and suction pressures is used to apply power to the three-way valves only when the pressure difference across the system is less than 4 psi. Thus, the solenoid coils are energized only for a fraction of a second, until a greater pressure difference is established when the unit resumes operation.

Any refrigeration system that cools air near or below freezing temperatures will accumulate frost on the cooling surface, which will in time seriously reduce the capacity. Since a heat pump provides heating under a wide range of outdoor conditions, the frequency of this frost formation is completely unpredictable. Consequently, a simple time cycle for defrosting the coil is inadequate and some method must be provided which senses the amount of frost accumulated.

There are several characteristics of a refrigeration system, such as suction pressure or power input, which tend to change with frost formation and could be used for frost detection. However, these methods are quite insensitive. One of the most effective methods for sensing frost is a measurement of the air pressure drop across the coil, which increases in direct proportion to the amount of frost collected. This method is very sensitive to frost accumulation, and, after extensive field and laboratory tests had proved its reliability, it was decided to use it in the design under discussion.

A switch sensitive to static pressure difference is installed across the outdoor coil. Closing the switch energizes a relay which locks itself in the circuit through one of its own contacts to prevent an erratic defrost cycle. Defrosting is similar to a normal cooling cycle, and the heat pump follows its usual procedure for switching from heating to cooling. There are, however, two basic differences between the cooling and defrosting cycles. First, the outdoor fan does not operate, thus preventing cold air from passing over the coil. Secondly, a valve is opened so that most of the refrigerant by-passes the indoor coil, removing little heat from the conditioned space. When the defrost cycle is complete the unit returns automatically to its normal heating cycle.

In any air-to-air heat pump, a major design problem is to obtain maximum heating capacity at low outdoor temperatures. Since heat transfer to the compartment which handles the cold outdoor air can be an important factor, it was decided to divide the unit into three thermally isolated sections: outdoor air, indoor air and machinery compartments, shown in Fig. 4. The outdoor air compartment is completely isolated thermally from the indoor air and machinery compartments by double metal barriers with vapor-proof insulation be-

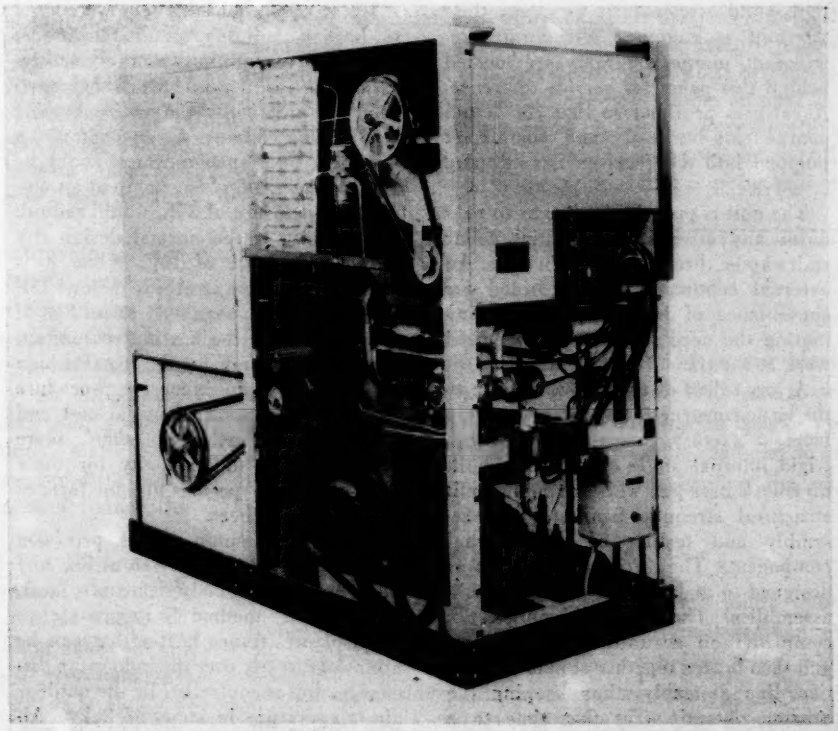


Fig. 4. 3-hp heat pump, outside panels removed, showing outdoor air circuit at rear of unit and indoor air circuit above machinery compartment.

tween. New water-proof insulation and aluminum faced glass fiber are used because of their good resistance to moisture as well as their excellent insulating properties.

In addition to the precaution taken to assure minimum heat leakage between sections, every opportunity was taken to recover normally wasted heat losses from the machinery itself. The heat from the fan motors, the compressor and compressor motor is recovered and utilized as useful heat during the heating operation.

To obtain the most efficient refrigeration system the outdoor coil was made larger than the indoor coil and the air flow increased proportionally. A section of the indoor coil is used to extract additional heat from the refrigerant by subcooling it directly in the indoor air. Other features contributing to the high over-all efficiency of operation are a suction gas heat interchanger which is used in the refrigerant circuit to assure better compresser performance at low outdoor temperatures, and a built-in condensate trap in the drain piping to eliminate air leakage between indoor and outdoor air compartments, which otherwise would have occurred through the drain lines.

An air distributor, available for in-space applications, permits adjustable air discharge in three directions.

To facilitate field servicing, components most apt to require maintenance are located behind the front panel which is easily removed. The removal of this panel does not hamper normal operation, so adjustments can be made while the unit is running. Wiring and refrigerant piping diagrams are located behind this panel for service reference. A valve is provided so that the liquid charge can be easily and completely pumped into the receiver for shipping or service.

The unit is proportioned so as to pass down any adequate residential cellar stairway or through a 28 inch door. An external conduit box is provided for convenience of installation, thus eliminating the need for internal electrical work at the time of installation.

A great deal of thought was given to the basic construction of this heat pump from a factory assembly standpoint. Rigid internal angle construction built up from a base pan while giving the unit structural strength facilitates the assembly and testing of the internal components. The refrigerant piping was designed to make maximum use of sub-assemblies. These sub-assemblies are completed on accurate bench fixtures and then brazed together at final production line assembly, thus keeping the brazing operations at that time to a minimum.

The following design features keep the noise level of the unit to a minimum: large fans operate at low speeds; the motor-compressor unit is spring mounted; the entire enclosure is insulated with sound absorbing insulation; all panels and baffles are designed to avoid sounding board effects; and fan bearings and fan motors are resiliently mounted. Sound transmission through the refrigerant piping is minimized with vibration suppressors and glass fiber insulation.

Fig. 5. New Jersey home using 3-hp packaged heat pump.

## Application

If a heat pump of this type were sized to heat a building under the lowest temperature conditions in any given location the result would be an oversized unit for practically the entire heating and cooling seasons. As an example, a house in Chattanooga which could be heated with a 3-hp heat pump at an outdoor temperature of 25F, would require a 5-hp unit at the normal design dry bulb temperature of 10F. When it is realized that temperatures below 25F occur in Chattanooga only about 3% of the time during the heating season, sizing the heat pump for the usual design temperature is an expensive procedure from the standpoint of initial cost and operating expense. It is much more economical to add capacity for these few "cold snap" periods in some form of supplementary heat.

In this heat pump design, provision was made for the owner to utilize any of several forms of supplementary heat, The simplest method is to provide an accessory resistance heater that can be attached directly over the indoor fan discharge, and is controlled by the outdoor air temperature in steps of 2 kw. Although large quantities of water may not be available for extracting heat throughout the entire heating season, it may be feasible to use water as a heat source during those few hours when the air does not provide sufficient heat, so city water can be used satisfactorily in many localities for short periods without becoming too costly. To allow the owner of the heat pump the option of using water for supplementary heat, the heat pump described in this article has provisions for field installation of a water chiller to be used in place of the outdoor coil in periods of extremely low temperatures.

True field conditions are virtually impossible to attain in a laboratory test, so one of the many field installations made was a 3-hp heat pump installed in a residence in northern New Jersey, shown in Fig. 5. This house is a typical development home consisting of a living room, dining room, kitchen, 2 bedrooms, full cellar and expansion attic, well insulated and with storm windows. The thermostat is kept at 74F and the heat pump is capable of maintaining this temperature at all outdoor temperatures above 23 degrees. When the temperature drops below this point, supplementary resistance heaters are used to provide the required additional heat. The heating performance of the complete heat pump with no supplementary heat varies from 11.7 Btu per watt input at 50F outside to 9.5 Btu per watt at 20F. The cooling capacity rated at 3 tons is adequate for complete summer air conditioning.

## Conclusion

The development program for this unit made it possible to mass produce an efficient, compact and completely automatic year-round air conditioner. The heat pump as an advanced means of controlling "indoor weather" is now available to the American home owner.

# What Would You Do?

## Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

### Here is the Problem

**Because of the large amount of abrasive material present in the air of our foundry, normal duct design and installation cannot be used. What can you suggest for us to follow that would prolong the life of the ducts and possibly increase their efficiency?**

EACH month, in this department, there is a discussion of some problem that is of interest to many industrial plant engineers. In this way, it is possible to present the experience and knowledge of engineers who have had the desired specialized training.

Should you have a problem that you would like to see discussed in this department (provided it is of interest to the industrial plant engineer) or if you have some comments that you would like to add to the discussion of problems scheduled for future discussion, you are invited to write to the editor.

The current problem, dealing with the life of ducts in an abrasive atmosphere, is one that is faced in many industrial plants.

#### Solution

Ducts should be made of not less than 20 gage material when they handle ventilation air. Ducts with a diameter or maximum dimension of from 18 to 30 inches should be made of 18 gage material. Ducts over 30 inches should be made of not less than 14 gage material. Long unsupported sections of duct may require heavier material. Welded rather than riveted construction is desirable for abrasive air handling.

Wherever possible, ducts subject to abrasion on one side should be constructed in flanged sections so the duct section can be turned to a new position before any side is worn through, thus accomplishing a longer duct life. Other parts of duct exhaust subject to heavy abrasive wear can be profitably equipped with removable heavy gage wear sections. Points to check regularly for abrasive wear include backs of elbows, transitions, main ducts opposite branch inlets, and fan housings. Small primary separators at tumbling mill connections will reduce the abrasion on those ducts.

Clean-out openings should be provided in all duct systems, but a minimum number will be required where high duct velocites of 4,000 fpm and up are used or where the ducts are large enough to crawl into. Tight seals should be furnished on doors in pressure ducts to eliminate dust leaks into the foundry building.

Remove dead runs or low velocity runs of piping in dust collector systems to prevent the filling up and collapse of the duct. Ducts serving tumbling mills are especially dangerous in this respect. Any duct with capped branches should be viewed with suspicion.

If ducts plug up during cold weather only, condensation in the duct may be the trouble. The remedy is insulation of the duct, installation of air heaters in the area if the duct is inside a building, or direct application of heaters to the duct.

Horizontal runs of ducts attached to mold conveyor pouring, cooling, and break-apart hoods should be checked and cleaned regularly to prevent the accumulation of combustible materials. Core ovens and ducts should be checked regularly for the same reason.

All volume control dampers for exhaust hoods and duct branches should be kept in proper adjustment with the settings marked on each control so the proper settings can be easily duplicated. To prevent unnecessary heat losses, do not over-ventilate exhaust hoods. Hoods over transfer points of sand handling systems should be carefully baffled to prevent unnecessary loss of bonding materials and sand fines.

A convenient method of checking for changes in the operating characteristics or air handling systems is to drill and tap ⅛ inch pipe size holes in ducts near exhaust hoods and fans and in dust collector housings. A glass or plastic U-tube with a rubber tube and one-hole rubber stopper attached to one leg can be used to obtain an approximation of the static pressure at any point. As duct turbulence will give erratic readings at some points, find a point where

### Problems for Coming Issues

#### April Issue

**A new production area is to be added to our plant which calls for a quenching bath for steel. What are some of the cooling problems involved in cooling the quenching oils for such a bath? I was informed that the shell and tube heat exchanger is most economical for cooling the oil. Is this so?**

#### May Issue

**In the past we have been using cement joints when laying tile pipe. This joint does not permit settling of pipe and we have experienced some broken pipe. Hot poured compound joints have been recommended. What compound can be use? Will it permit some movement?**

stable readings can be obtained. The desired ventilation volume should be measured by air velocity instruments and the test hole reading noted. By periodic checking, the permissible variation at the test hole can be established and marked directly at the most important test points. Thus the maintenance man can tell by a single check whether an inspection, adjustment, or cleaning is in order.

*Kenneth M. Smith*
*Foundry Engineer,*
*Caterpillar Tractor Co.*
*Peoria, Ill.*

In order to prolong the life of ducts located in foundries where large amounts of abrasive materials are present in the air, certain basic design standards should be observed. Round black iron ducts are normally used of at least 16 gauge thickness. Elbows and transitions should be made of material two gauges heavier. All joints should be welded to prevent air leakage. Bolted flange connections should be used where required to permit access for inspection and periodic cleaning. Long sweep elbows with a radius of 2½ duct diameters should be used to prevent undue wear at these points in the system. In ducts carrying exhaust from sand blast operations, the heel of the elbows can profitably be reinforced to withstand the wear from the entrained abrasives.

Lead-ins from the various exhaust stations should meet the main trunk duct at not more than a 30 deg angle to reduce turbulence and consequent wear at these points. Duct velocities should be held down to 4,000 to 4,500 fpm which should be sufficient to prevent dirt retention inside the ducts. While moisture is usually no problem, where it is prevalent, eliminator plates should be included at the duct entrance at each exhaust station. The use of rubber lined ducts would be a last resort in view of their high cost, but in certain cases it may be economically justifiable as where rubber incased pump impellers are used in the flotation process in silver mining.

To prevent excessive duct wear in recirculating heating systems, the installation of an automatic self-cleaning filter is recommended. Filtered air not only is beneficial to employe's health but it also prevents clogging of coil surfaces which renders the system inadequate in both air and heating capacity. Automatic filters are vital, even with normal good maintenance, to keep the system operating efficiently and provide against human negligence.

*J. Partington, Jr.*
*Engineer, Air Conditioning Dept.*
*General Electric Co.*
*Bloomfield, N. J.*

The obvious answer to the question, "What can you suggest for us to follow that would prolong the life of the ducts and possibly increase their efficiency?" is to remove the offending dust. This can easily be done by the use of a dust collector.

We will assume for purposes of illustration that you are handling 10,000 cfm in a duct with a velocity of 3,800 fpm. The duct would then have a diameter of 22 inches. It would only be necessary to remove a 12 ft. length of duct and insert a dust collector to successfully remove the material. The pressure drop from inlet to outlet of the dust collector would be 1½ inches S.P. W. G. Foundries are successfully using this method.

*Mack Gordon*
*Aerodyne Development Corp.*
*Cleveland, Ohio*

## Dallas to Have Air Conditioned Skyscrapers

A spectacular group of modern skyscrapers is rising deep in the heart of Dallas, Texas, and all will be completely air conditioned, it was reported by Carrier Corp., which is furnishing most of the air conditioning and refrigeration equipment.

Eleven multi-story air conditioned office buildings and hotels, totalling some 175 floors and more than 50 acres of floor space have been under construction or completed in the city center during the past two years alone. Ten of them are located within a four block radius of the intersection of St. Paul and Live Oak Streets and Pacific Avenue, and the eleventh is only three blocks farther out from this area.

Giant of them is the new 36-floor Republic National bank building—its tower will rise some 600 ft. Scheduled for completion in the fall of 1952, the Republic National building will have the largest Weathermaster air conditioning system ever installed in the Southwest, with more than 2,500 room units providing year-round temperature control for occupants. The largest ever installed in a single structure is the United Nations Secretariat building's 4,000 unit system in New York City.

Next in height is a new 23-story wing for the Adolphus Hotel at Main and Akard Streets. With this addition, the Adolphus claims to be the biggest completely air conditioned hotel in the world with some 1,300 weather-controlled guest rooms.

Checking in at 17 stories each and providing nearly 8½ acres of office space between the two of them are the Corrigan Tower at St. Paul St. and Pacific Ave. and the Fidelity Union Life Insurance building at Bryan, Bullington, and North Akard streets.

Six of the buildings bear insurance company names, including Gibraltar Life, the Great American Reserve Insurance Company, Employers Insurance, Rio Grande National Life, and Reserve Loan Life. The list of 11 also includes the Mercantile Securities and the Mercantile Commerce buildings, both completed in 1950, across Commerce Street from each other between St. Paul and Ervay streets.

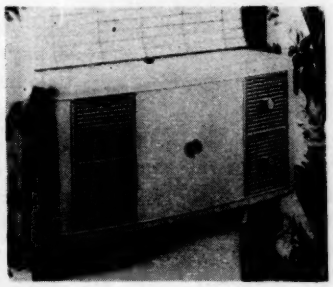
Most of the refrigeration is supplied by centrifugal machines. The Employers Insurance building has three absorption refrigerating machines. All but two of the buildings have specified the Weathermaster system.

# NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite Page 110 for securing additional information on items described in this department.

## Window-Sill Air Conditioners

A ⅓ and a 1 hp. window-sill type room air conditioner with a hermetically sealed refrigeration circuit are announced by York Corp., York, Pa., for 1952. The ⅓ hp model has a suggested retail price of $229.95, while the 1 hp. conditioner is priced at $459.95.



The company has also refined five other room air conditioner models including the ½ and ¾ hp. window-sill type units and the 1, 1½ and 2 hp. console types with a retail price range on the east coast from $319.95 to $990.

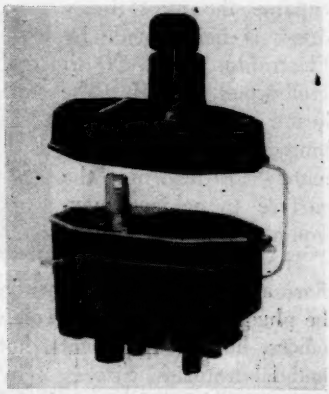
The ⅓ hp. unit, known as Model 4, protrudes only ten inches in the room, has great economy of operation, and can be installed in almost any type window. It is claimed to be the only ⅓ hp. air conditioner to have 4-way adjustable air distribution grilles, and features heavy duty, disposable type filters easily reached without having to remove the cabinet from its mountings.

The 1 hp. conditioner, known as Model 51, was designed for handling large size rooms. Draft-free circulation is accomplished by easily adjustable rotary grilles. The far-corners of the room are reached with cooled air by means of the large multi-blade disc type fan.

For more information, circle on Inquiry Card, **Item 1**

## Flame Control for Oil Heaters

A new Flame-Modulator, Model CRC-239-MP, add-on control recently placed on the market by Detroit Lubricator Co., Detroit, Mich., provides users of oil burning space heaters equipped with the company's CRC-239 float valves a simple, inexpensive means of obtaining thermostatic control.



As its name implies, the device fully modulates the oil burner flame from *high* to *low* in accordance with room temperature demand. The temperature - sensitive bulb is usually installed in a wire clip which is fastened to the valve mounting bosses on the valve proper.

Installation is simple. There is no electrical wiring to be done, nor wall thermostat to be installed. The modulator may be installed by the dealer in the customer's home, or it may be applied to the heater in the heater manufacturers plant.

Because of its full modulating action rather than snap-action between *high* and *low*, the unit assures that just enough heat is delivered to the room to overcome the heat loss. This eliminates chilly under-heating and wasteful over-heating and provides practically perfect control of room temperature.

For more information, circle on Inquiry Card, **Item 2**

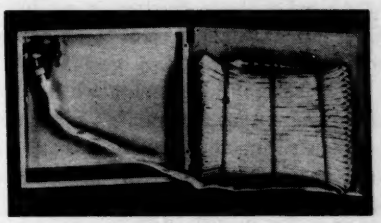
## Aluminum Fillers for Holes

Powdered aluminum, a mastic filler material for blow-holes, fractures in castings, and similar uses, is available from A. L. Okun, Flushing, N. Y. The aluminum is in a quick drying non-soluble liquid vehicle and is supplied in a semi-fluid form for application with a putty knife or by brushing or spraying after it has been thinned down with a solvent supplied by the manufacturer.

For more information, circle on Inquiry Card, **Item 3**

## Packaged Fire Fighting Station

The Allenco fire hose station, a foolproof fire-fighting tool for small premises such as dwellings, shops, resorts, and farm buildings, is announced by W. D. Allen Mfg. Co., Chicago, Ill.



The welded steel cabinet is compact, only 14-inches wide x 12½-inches high x 4-inches deep, designed for recessed installation between studs or for wall mounting with up to 75 feet of linen hose. Atop the folded hose is the permanently connected, adjustable brass nozzle. Locked into the hose itself, the nozzle cannot be removed and thus is sure to be ready for emergency use. With a twist of the fingers it can deliver full stream or the foggy spray that is best for smoldering fires.

The other end of the hose is attached to a simple valve connected to the regular water supply. Just turn on the faucet, pull the nozzle and up to 6 gallons per minute is directed to any point within 75 feet.

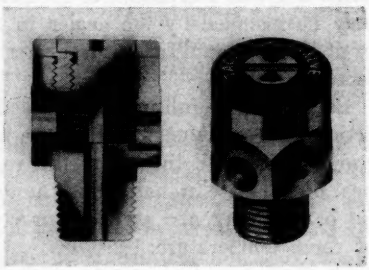
The station is as easy to use, requires no charging or attention at any time, and discharges no chemicals. It is not limited to a brief squirt and involves no installation problem in new or existing structures.

Various models ($38 to $50) offer different hose-lengths, glass-sealed door and other features. Each combines, in effect, extinguisher and cabinet. It has a market in both new construction as well as existing buildings.

For more information, circle on Inquiry Card, **Item 4**

## Extra Small Steam Air Valve

An air valve for steam heating systems, made in one size but which can be used on radiators or mains, has been introduced by Taco Heaters, Inc., Providence, R. I. It works on new principle and measures only ¾ x 1 inch, or less than a quarter the size of conventional air valves.



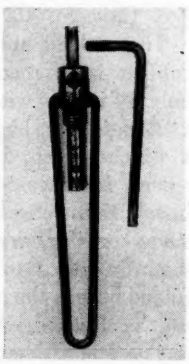
Air is forced out between composition discs by steam pressure; as steam enters the valve, the moisture swells the discs, which are so sized and of such material that they will not completely seal until all air has been forced out and the valve is full of steam. After the thermostat is satisfied and steam subsides, the system may go into a vacuum for a few minutes after which the discs dry and shrink and are ready for another cycle.

Advantages claimed include: No small port to clog; no floats to stick or collapse, or no diaphragm to snap or pop; no hiss or ping. It can be manually operated whenever necessary, and can be installed in any position except upside down.

For more information, circle on Inquiry Card, **Item 5**

## Power Drilling In Concrete

A line of Bulldog special flush shells for power drilling in concrete, brick or stone has been introduced by Polis Mfg. Co., Chicago, Ill. These shells are used with an electric or air hammer and the shell is a combination drill and anchor.



The special flush shell has a tapered chucking end for mounting on chuck while drilling the hole and expanding the shell. After hole is drilled and shell expanded this chucking end is broken off flush with face of surface by a quick, sharp lateral strain on the chuck. Another method is by striking the shell a blow with a hand hammer after chuck has been removed.

Bolt sizes of shells available are ¼, 5/16, ⅜, ½, ⅝, and ¾ inch. Illustration shows shell in chuck with ejector key.

For more information, circle on Inquiry Card, **Item 6**

## Adjustable Drain for Roofs

The Leveleze roof drain has been developed by Josam Mfg. Co., Michigan City, Ind. Formerly, where the roof drainage piping had been installed and the roofs laid, if the drain was too high or too low, substantial alterations were required.

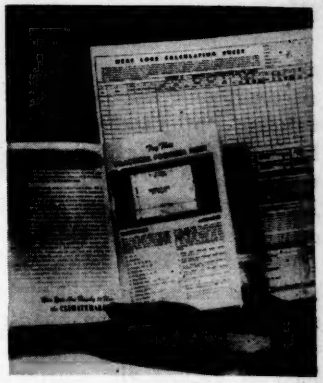
The new drain is adjustable, so that there is no need for extensive alterations because of miscalculations in roof levels. Simply raise or lower the adjustable top of the drain to the proper elevation. In the same manner this drain can be easily adjusted should the roof level be changed at a future time.

Another feature is that the body can be installed in the rough slab to act as a drain for rainfall during construction and prior to finishing the roof and insulation. After insulation is down the adjustable collar can be fitted to meet any thickness and so provide finished roof drainage.

For more information, circle on Inquiry Card, **Item 7**

## Slide Rule Instructions Simplified

In connection with its Climatemaker heat loss computer, described on these pages some months ago, the Climatemaker Heat Loss Calculator Co., Bloomington, Ill., has completely revised its instruction book on the use of the slide rule computer. The revision was undertaken by the advertising agency for the company who discovered in the survey that the instructions were too technical. The new book has been entirely redesigned, illustrations have been added and the copy written in plain language so that anyone can understand and apply what he reads.



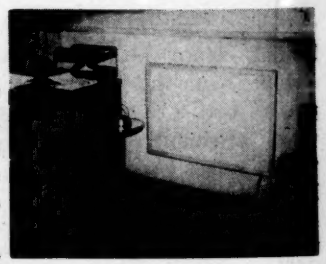
The book now includes a sample heat loss problem on an average 9 x 12 ft room with answers for each step so the dealer can check his calculation on a theoretical case first. An example on "how to figure cost of heating per season" is also included in the book.

The one chart needed to use the heat loss computer has also been revised and simplified along the same lines.

For more information, circle on Inquiry Card, **Item 8**

## Low Temperature Electric Panel

The electric Hot-Rock panel heater, which will not enflame the most flimsy dress, is being made by Electrofilm Corp., North Hollywood, Calif. The heater attains a uniform temperature of approximately 190 deg. over the surface to achieve maximum warmth.

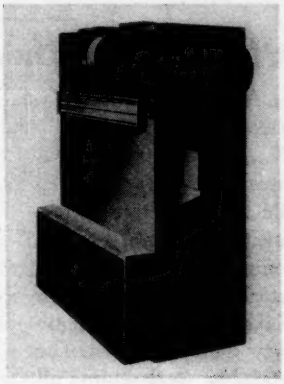


The unit can be hung flush against a wall or suspended from the ceiling. It may be plugged into any 110 volt circuit. It is designed for offices, homes, apartments, hotels and motels, elevators and laboratories. Size is 2 by 3 feet, finished in grey with natural wood frame. Furnished complete with 6-foot plug-in cord, the heater retails for $39.50.

For more information, circle on Inquiry Card, **Item 9**

## Air Conditioning Cabinets

The Buffalo Model G air conditioning cabinets are introduced by Buffalo Forge Co., Buffalo, N. Y. These units are available in both horizontal and vertical models in sizes from 875 to 22,000 cu. ft. of conditioned air per minute. Combinations may be had for any function or functions of air conditioning, including simple cooling, summer cooling and dehumidifying, winter heating and humidifying, and continuous air cleaning. All units may be equipped with an air washer section, as well as automatic controls, if desired.



A number of design changes have brought about improved efficiency, more flexibility, simplified installation and easier maintenance. All parts are standardized, for quick replacement. Construction is sectionalized to permit a wide variety of combinations and easy assembly on the job. Blower wheels are of light, efficient, quiet design for stable performance over a wide range of capacities and pressures without vibration or approaching critical speeds. Overall appearance is greatly improved, and the new vertical type VPC cabinets are made even more compact than before by the use of flat type Hi-Velocity filters.

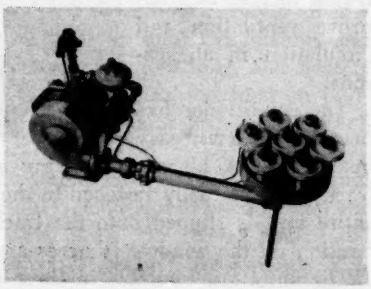
Bulletin 303A, which includes capacity tables, diagrams, charts and detail photos to aid in the selection of the proper unit for given conditions, is avalable.

For more information, circle on Inquiry Card, **Item 10**

## Conversion Unit Has No Flame

A gas conversion unit which operates without discernible flame and reduces fuel waste is being marketed by Burdett Mfg. Co., Chicago, Ill.

In the Radiant Glow unit, the gas-air mixture is blasted against a high-temperature refractory at 2300 deg., designed to keep the fuel mixture in contact with the burner surface. In this unit it is claimed that the gas-air mixture cannot pass the combustion zone without reaching combustion temperature, and for this reason maximum combustion and economy of operation are attained.



The unit will convert any gravity feed or forced air furnace, or any steam or hot water boiler of 100,000 to 200,000 Btu per hour requirements for operation on any type of heating gas, manufactured, natural, mixed, propane or butane, at important savings.

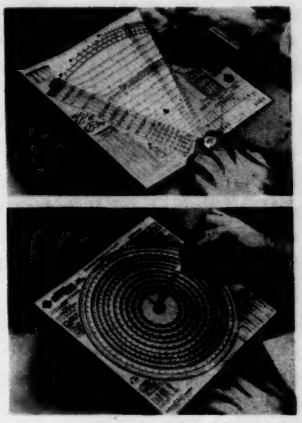
The new unit is quiet in operation and easy to install, being factory-assembled and wired, requiring only mounting in place and connection to the power drive.

For operating safety, a baseoid safety control and automatic gas valve protect pilot operation and main gas supply control. Three sizes are available.

For more information, circle on Inquiry Card, **Item 11**

## Plastic Pipe Layout Computer

Using only four readings from a center line, pipe layout is simplified and time saved with new, accurate computers having pointers made of stable Vinylite plastic rigid sheet by Interstate Sales Co., New York, N. Y. Engineers, piping foremen, draftsmen, and sheet metal workers can make layouts right on the job of pipe bends up to 126 degrees.



The computer (top photo) gives direct readings for any angle of bend up to 126 degrees, in steps of one degree or less, on pipe diameters from one to 20 inches. Complete angles of two pieces or multi-piece bends, Y-layouts, etc., are read on the computer and transferred quickly to the actual pipe, sheet metal, templet or drawing board. This instrument gives distances in inches along the pipe from a vertical center line. Only four measurement readings are required to mark a pipe (by quadrants) at 16 different ordinate points on the circumference.

The circle divider (bottom photo) gives instant reading of circumference divisions from ½ to 1/16 in fractions of an inch for any circle up to 72 inches in diameter. This divider is handy for getting ordinate spaces for templet layouts. Both instruments are available in folding type for field use and flat type for the shop. Both measure 12 inches square flat, 12 by 4½ inches folded and ready to fit pocket or tool box.

For more information, circle on Inquiry Card, **Item 12**

## Weatherstrip for Glass Doors

A new device combining plastic easy-grip weatherstripping with an extruded rubber inset that will eliminate drafts, dust and any whirring noise from air passing through abutting glass doors, has been named Abco and introduced by Abbott Glass Co., New York, N. Y.

Designed exclusively to fit tempered herculite glass doors and constructed so that it can be easily slipped on and off the edges, the device was developed after a year's research for the best method to correct the draft problem experienced by practically everyone having modern glass door installations. Price is $12.50 per seven-foot strip.

For more information, circle on Inquiry Card, **Item 13**

## Portable Emergency Air Mover

An improved device for moving large volumes of air quickly and economically in situations requiring intermittent or emergency ventilation, is introduced by Mine Safety Appliances Co., Pittsburgh, Pa.

Portable and light-weight, the instrument is adaptable for use in industrial plants, mines and wherever else circumstances make it necessary to remove air contaminants from confined areas or to introduce fresh air for safe ventilation or rapid cooling.

Called the Lamb Air-Mover, the device employs compressed air or steam in its principle of operation. Horn shaped, with a bell-formed base, the device induces the air flow. The steam or compressed air is fed through a side inlet at the bell end. Expanded at high velocity it is discharged through the outlet horn, drawing with it a large volume of the air to be moved.

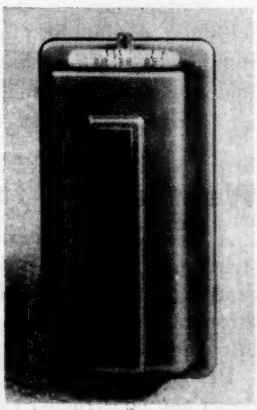
Initial cost of the device is reported to be low, compared with a motor-driven unit of the same capacity, usually about one tenth the cost of an electrically-driven explosion-proof blower and exhauster. There is no upkeep, since it contains no moving parts to replace or maintain.

Three models are available: The No. 3 model, which is capable of moving 800 cfm with a 90-lb. line pressure supply; the No. 6, moves as much as 3,150 cfm minute at 70-lb. line pressure; and the No. 10, handles 5,160 cfm at 80-lb. line pressure.

For more information, circle on Inquiry Card, **Item 14**

## Low Cost Humidity Control

A sensitive, low-cost humidity control has been developed by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., and is now in volume production.



Considerably less expensive than the company's electronic model, the new humidity control was designed primarily for manufacturers of portable and package humidifying and dehumidifying systems and for other applications which require a low-cost humidity controlling device.

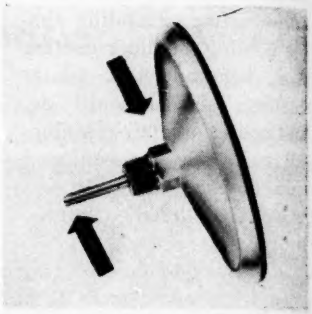
The new control, H 64A, when tested in a special chamber, proved to have an operating differential of less than 5%. During the test, air was moving through the chamber at 1,200 feet per minute, the approximate air movement when the controller is mounted in a duct, and the rate of humidity change was 1% per minute. The differential is even less when the rate of change of humidity is slower.

Heart of the electrical humidity device is a hair element, extremely sensitive to moisture in the air.

For more information, circle on Inquiry Card, **Item 15**

## Welded Dial Thermometers

A new process for welding thin sections of stainless steel is being used by Rochester Mfg. Co., Inc., Rochester, N. Y., on its stainless steel, dial type, bi-metallic thermometers which, by this process, become one assembly of case, stem and connection nut. Like spot welding, no new metal is added. The stainless steel retains all its corrosion resistance.



The new construction insures ability to withstand corrosive and erosive conditions on all exposed surfaces. It will increase the range of applications for dial thermometers whose large, easy-to-read dials have made them popular.

Freedom from breakage and release of contaminating liquids, and the high corrosion resistance will eliminate costly separable sockets for many process applications. Increased speed of response and high accuracy will result.

For more information, circle on Inquiry Card, **Item 16**

## 3 Sizes Room Air Conditioners

A new year-round air conditioner with tested economy of operation and installation is introduced by Crosley Division of Avco Mfg. Corp., Cincinnati, Ohio. In addition to cooling and dehumidifying rooms in summer, the unit is adapted to exhaust stale, smoky air during the fall, winter and spring months and improve ventilation and circulation in all seasons.

The conditioner has been designed for easy installation. A kit accompanying each unit contains a track which is easily fastened to the window sill and the entire unit is slipped onto the track and bolted. No alteration on the window is necessary.

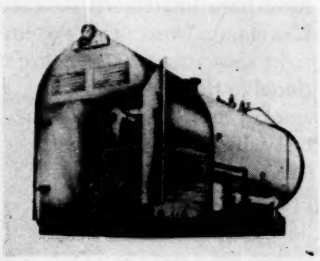
The units are available in three sizes, 1/3, 1/2, and 3/4 hp., priced at $249.95, $349.95 and $399.95. The 3/4 hp. unit is shown in the photo.

The conditioner has a three-way adjustable outlet grille, making it possible to direct the flow of the air to any part of the room. It is engineered for noiseless operation and has simplified, clearly marked controls.

For more information, circle on Inquiry Card, **Item 17**

## "Doghouse" Protects Boilers

While most boilers are installed in boiler rooms, this is not always the case. Superior Combustion Industries, Inc., New York, N. Y., reports that many of its steam generators have done temporary outdoor duty while boiler rooms were under construction or renovation.

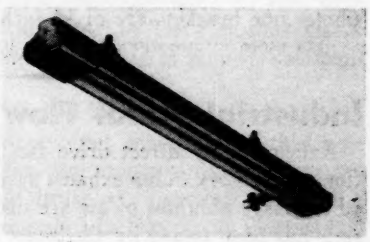


More recently, a number of these steam generators have been built especially for outdoor installation. To cover the vital working parts, a special housing, called a dog house by men in the plant, has been designed. While providing the required protection, this housing makes all working parts readily accessible. Safety features include power lockouts to prevent operation with the doors closed when an engineer is in the enclosure. Construction is simple, watertight, and effective.

For more information, circle on Inquiry Card, **Item 18**

## Electric Heaters for Industry

The problem of keeping workmen warm and working in hard-to-heat locations, both indoors and out, can be solved in many cases with the Chromalox electric radiant comfort heater made by E. L. Wiegand Co., Pittsburgh, Pa.



Typical outdoor operations using the glareless all-metal heaters include truck and boxcar loading, receiving and shipping desk work, watchmen's houses, and some maintenance jobs. The portable units can be used indoors where neither central heating systems nor other auxiliary heating sources are adequate; for instance, in large open rooms in poorly insulated buildings.

The units are equipped with a 6-inch length of BX cable and plug and two movable mounting clamps and bolts. Readily adaptable to many locations, and heaters can be bolted along side of machines, mounted on portable rigs—or simply laid on the floor to warm worker's legs.

Three models are available. One is 24½ inches long, 800 watts; a second is 30¾ inches, 1100 watts; and the third is 46¾ inches, 1800 watts. Protective grilles and input controllers for selective heating are optional.

For more information, circle on Inquiry Card, **Item 19**

## Panel Vent Sets, 3 Fan Sizes

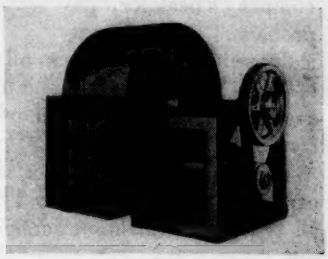
A new, moderately priced panel vent set, for use at free delivery or relatively low static pressure, is introduced by DeBothezat Fans Division, American Machine and Metals, Inc., East Moline, Ill. These units are available with fan wheels 24, 30 and 36 inches in diameter, with air-moving capacities up to 13,190 cfm. All vent sets have totally enclosed ball bearing motors, wound for dual voltage. Retail list price, $188 and up. Shutters and safety screen guards are available at extra cost.

Bulletins containing illustrations, construction details, certified capacity ratings and dimensions are available.

For more information, circle on Inquiry Card, **Item 20**

## Belt Driven Blower Line

Several new size belt drive utility blowers are now being produced by The Peerless Electric Co., Warren, Ohio. The new models include smaller units for use in electronic cooling and larger units for general drying, exhaust, ventilation and air driven conveyor systems. Blower sizes available now range from 9 inch to 30 inch diameter wheel, with horsepower ratings from 1/6 to 7½.



Features include: adjustable pulley speeds, vibration dampeners, weatherproof covers and interchangeable motors produced by the same manufacturer.

For more information, circle on Inquiry Card, **Item 21**

## 3 Gal. per day Dehumidifier

An electric dehumidifier that can remove from the air up to three gallons of water every day is available from Westinghouse Electric Corp., Electric Appliance Div., East Springfield, Mass. It is intended for photographic dark rooms, bank vaults, print shops, candy factories, beauty parlors, locker rooms or other interiors where excessive moisture is a problem.

The drier is large enough to dehumidify an enclosed space up to 10,000 cubic feet. For areas where relative humidity conditions do not require continous operation of the dehumidifier, a timer clock is available as an accessory.

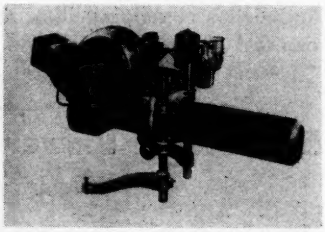
The drier is 24-inches high, 14-inches wide, and 19-inches deep; it is portable and can be operated on standard 115 volt a-c service, and needs no plumbing or other permanent installation.

Cabinet is finished in blue-gray enamel. The hermetically-sealed refrigeration system is covered by a five-year guarantee plan. It is sold at a suggested retail price of $151.50. The time clock is listed at $9.95.

For more information, circle on Inquiry Card, **Item 22**

## Switches Fuel Automatically

A combination oil and gas burner which switches from one fuel to the other either automatically or manually, as desired, is announced by Synchronous Flame, Inc., Chicago, Ill.



The burner, the Syncro-Flame, was developed by engineers of the Wisconsin Southern Gas Company in their search for a highly efficient dual burner to solve the company's peak load gas problem. By automatically switching from gas to oil during the coldest weather, the dual burner permits gas companies to control their gas supply and offer a more attractive lower rate to consumers.

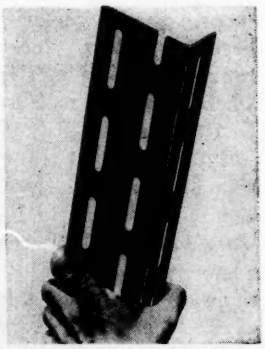
The Syncro-Flame burner is made in four sizes, with capacities from 100,000 to 1,350,000 Btu per hour, for all types of residential, commercial and light industrial use.

Among the features are: automatic electronic ignition which eliminates a standing pilot light; electronic safety controls shut the burner off instantly in case of gas, oil or electric failure; it operates quietly and cleanly; radiant, swirling flame is adjustable for highest combustion efficiency for either gas or oil; it burns natural, manufactured, mixed or LP gas and from No. 1 to No. 3 oil; an outdoor temperature control can be used to automatically switch the burner from gas to oil or oil to gas when the temperature reaches the control setting.

For more information, circle on Inquiry Card, **Item 23**

## Angles for Scaffolds, Supports

The availability of DexAngle, a 10-ft long, 3 x 1.5 x .080-in. slotted-leg galvanized-steel angle designed for all-purpose industrial fabrication is announced by Acme Steel Co., Chicago, Ill.



The lengthwise rows of slots in this angle unit permit the rapid assembly by bolting of shelving, bins, scaffolding, ladders, motor and machinery mounts, and other plant equipment.

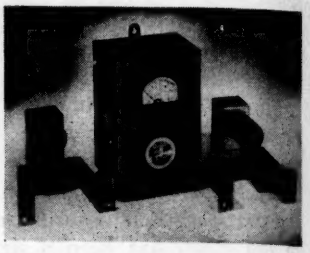
A hacksaw and a wrench are the only tools needed for assembly. Equipment can be built, altered or dismantled in a matter of minutes and the angles are 100% re-useable. No special brackets, braces, clips or hooks are required.

When used as uprights in lengths up to 5½ ft, these angles will individually support loads as high as 1200 lb. They are sold by the package. Each package contains ten 10-ft lengths of angle and 75 bolts and nuts. Shipping weight is approximately 110 lb.

For more information, circle on Inquiry Card, **Item 24**

## Smoke Control System

Smoke indicators and controls, photoelectric cell systems which provide a constant check on smoke density, have been introduced by Cleveland Fuel Equipment Co., Cleveland, Ohio. The system consists of three units; a light source; a photoelectric cell whose output is proportional to the density of the smoke; and a master control with amplifier, relay, smoke density meter calibrated in Ringelmann units, and signal lights.



The indicators and controls are easily installed. The light source and photoelectric cell units are mounted on opposite sides of the breeching or smoke chamber, centered over two 2-inch holes in the breeching walls. The master control, which may be located remotely, can be set for a predetermined smoke density and no further adjustment is required. The indicator responds to any variation in smoke density. A non-adjustable time delaying circuit permits a small amount of smoke to pass before starting the control. This eliminates cycling of equipment.

Cabinet is made of heavy gage steel, finished in black baked enamel and is provided with hinged cover and lock hasp for easy accessibility. Wiring is BX or conduit to multi-terminal barrier strip in cabinet. Light source and photo tube brackets are of ⅛ inch steel.

For more information, circle on Inquiry Card, **Item 25**

## Industrial Axial Flow Fan

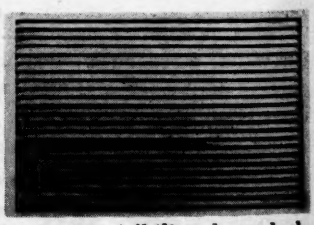
A heavy duty direct drive fan for industrial applications, duct work, mine exhaust systems and filtering units where large volumes of air are needed under static pressure has been issued by Chelsea Fan & Blower Co., Inc., Plainfield, N. J.

The fan is equipped with non-overloading, cast aluminum airfoil type propellers. Motors are totally enclosed. Units are available in sizes from 16 to 48 inches and with air deliveries from 2,900 to 37,000 cfm.

For more information, circle on Inquiry Card, **Item 26**

## Door and Partition Grille

A door and partition grille said to cut door grille costs up to 35% has been introduced by Titus Mfg. Corp., Waterloo, Iowa. The grille is made especially rugged so that there will be no rattle when the door is slammed. The frame is one piece, reinforced on either side and heavy gage steel is used throughout.



Louvers are V-shaped to prevent visibility through the grille, which is coated with a prime finish to blend with any color door. They are adaptable to any door width.

For more information, circle on Inquiry Card, **Item 27**

## New Miniature Noise-Meter

The Type 410-B sound level meter, used for measuring noise, sound, and vibration from equipment such as blowers and ventilating fans, has been introduced by Hermon Hosmer Scott, Inc., Cambridge, Mass. A rugged, compact, and accurate instrument is made possible by use of subminiature tubes and components.

This new model features greater low-frequency range, electrical circuit improvements, and mechanical design refinements. The sound-level range is from 34 to 140 decibels above the standard ASA reference level of 0.0002 dynes per square centimeter. Readily obtained hearing-aid batteries have an operating life of about 50 hours. Meter is available with a wide range of optional accessories, including carrying case, extension cables and vibration measuring equipment.

For more information, circle on Inquiry Card, **Item 28**

## Acid, Salt Resistant Coating

A new fluorinated plastic resin, resistant to the most highly corrosive chemicals and impervious to salt, heat and moisture, has been developed by The Firestone Tire & Rubber Co., Akron, Ohio. The resin is named Veloform F-10.

The coating can be applied as a lacquer. This gives it a decided advantage over other materials of this type having the same acid, heat and moisture vapor resistance. Application is a simple brushing, spraying or dipping operation and it can be used on metals, wood, plastics and rubber-like products.

For more information, circle on Inquiry Card, **Item 29**

## Line of Room Air Conditioners

The Vornado air conditioner was introduced to distributors at a sales conference by The O. A. Sutton Corp., Wichita, Kan. It follows in the steps of its sister line of air circulators, in deviation from conventional appearance.

The line consists of ⅓, ½, ¾, 1 ton and 1½ ton models. The ¾ ton model, 75WAC (illustrated), will retail for $419.95.

Twin air directors are a departure from the conventional and permit directional flow of cool air to different parts of a room at the same time with a velocity that gives deep penetration up to thirty feet into the room. This twin flow of air permits greater and more complete air movement within the room without drafts and results in a maximum cooling effect.

To accomplish the availability of variable cooling control, the units utilize a pressurized exhaust system which provides reduction of the cooling capacity from 8800 Btu per hour to 7700 Btu per hour. Simply by opening the exhaust damper, air is picked up immediately in front of the twin blower discharge thereby exhausting outside a portion of the over-all air being moved and reducing the amount of air through the cooling coils. The effect on the cooling capacity is the same as that realized by using a variable speed motor or the use of complicated speed controls for the reduction of the air flow through the coil.

The styling is an outstanding feature. Extending only 9½ inches into the room, the units are conservatively styled to blend with smart surroundings. Finished in neutral two-tone gray-green highlighted with burgundy and gold, the units will blend with any color scheme.

For more information, circle on Inquiry Card, **Item 30**

## Motor Line Increased

The addition of four frame sizes, expanding its line of standard motors to include 125 hp. ratings, is announced by Industrial Motor Div., Robbins & Myers, Inc., Springfield, Ohio.

The four new sizes are designed for all-weather operation, with special treatment to resist moisture and corrosion.

The four new ratings will be made in NEMA frames 444, 445, 504, and 505.

For more information, circle on Inquiry Card, **Item 31**

## Oil and Gas Steel Boiler Line

A complete line of oil or gas fired steel boilers for residential, commercial and industrial use, known as the Windsor horizontal tube series, is available from Portmar Boiler Co., Inc., Brooklyn, N. Y.

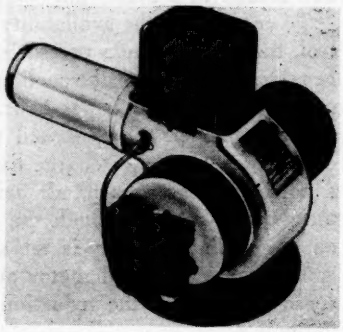
The boilers have scientifically arranged heavy gage steel boiler tubes, large furnace volume, long gas travels that permits complete absorbing of gases, and large hot water tankless copper coil. Boilers are tested under high hydrostatic pressure and designed so that parts are easy to reach for proper cleaning. Extended boiler jackets are also attractively designed, adding an extra touch of beauty to basements.

Boiler sizes range from: steam, 320 to 3,000 sq. ft.; hot water, 510 to 4,800 sq. ft., larger boilers are made to order.

For more information, circle on Inquiry Card, **Item 32**

## 1/2 Gal Per Hr. Oil Burner

An oil burner with a capacity as low as .50 gph has just been added to the line of oil burners manufactured by Sun-Ray Burner Mfg. Corp., Jamaica, N. Y. Approved by Underwriters' Laboratories to burn from .50 to 1.35 gph, it has been designed particularly for use with small boilers or furnaces where a clean flame with a high $CO_2$ and low stack temperature are frequently unobtainable with conventional burners.

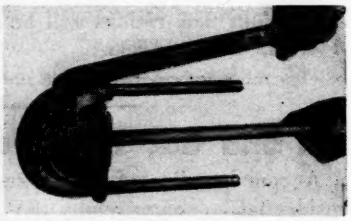


By use of the right combination of air handling devices, an efficient, trouble-free method of atomization has been achieved. Simple in design, easy to install and service, this burner can be supplied with either pedestal or various types of flange mountings to meet the requirements of most boilers and furnaces.

For more information, circle on Inquiry Chart, **Item 33**

## Two-in-One Tube Bender

A combination tube bender that bends both ½ and ⅝ inch O.D. copper, aluminum, brass and other soft, thin-wall metal tubing is being offered by The Imperial Brass Mfg. Co., Chicago, Ill.



The bender has a dual size shoe and mandrel which permits bending two different sizes of tubing without changing any parts.

Bender is of two piece construction and quickly comes apart and slips over the tube at the point where the bend is needed. Thus it can be used to bend tubing where one end is connected as easily as it can be used to bend tubing that has both ends free. The 2-piece construction also makes it easy to remove the bender from tubing after bend is completed, it is stated.

Bends can be made to any angle up to 180° and bender is calibrated to show degree positions. Overall length is 21 inches, and weight is 3 lb.

For more information, circle on Inquiry Chart, **Item 34**

## Plastic Ducts for Acid Fumes

Duct systems for chemical plants, made of tough, corrosion-resistant plastic, are being manufactured by United States Rubber Co., New York, N. Y. Tanks, liners, trays, hoppers, feeders, fume exhaust hoods, washers, stacks, fume troughs and gutters are being specifically engineered for the handling of acids, alkalies, aliphatic hydrocarbons and other basic chemicals. The ducts are marketed under the name Uscolite.

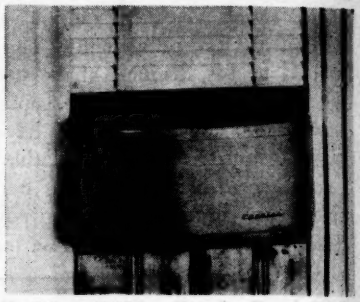
The equipment is an all-plastic assembly. No other material is used in construction. Reinforcing ribs, joints and corners are extruded from the plastic. Sheets used to form the sides, tops and bottoms of the ducts are of the same material. Rivets are injection molded from the plastic while bolts are machined from extruded tube stock. Joints are solvent welded with the same plastic in solution to form an airtight assembly.

The finished ducts are cheaper than stainless steel and more durable than galvanized steel or wood. Because of their relatively light weight they are easily installed.

For more information, circle on Inquiry Chart, **Item 35**

## Cuts Price on Window Units

Retail price reductions of $20 to $30 on its line of 1952 window sill room air conditioners, and a low price of $239 for the new ⅓ hp. window unit introduced recently, are announced by Carrier Corp., Syracuse, N. Y.



The new suggested retail prices list the ½ hp. window model at $329, the ¾ hp. model at $399, and the 1 hp. model at $469.

Also announced is the addition of a 1 hp. console model, available with optional water-cooled condensing.

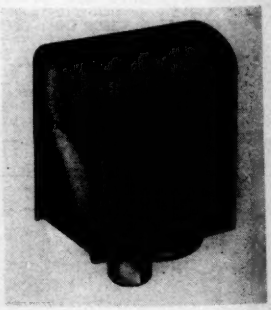
The ⅓ hp. window unit (illustrated) embodies the same engineering, construction, and design standards featured in the larger models. It was developed to meet a demand for small offices, bedrooms, etc., where cooling loads do not require larger-capacity equipment.

The unit is being produced in a pearlescent finish, which harmonizes with any combination of room colors. Window mountings are equipped with a weatherproofing seal.

For more information, circle on Inquiry Chart, **Item 36**

## Domestic Steam Limit Control

A tamper-proof, low-pressure steam limit control has been introduced by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.



The new unit, called Pressuretrol, can be applied to almost any domestic steam job. Its low cost has made it possible to make it available in quantity to manufacturers for installation as standard equipment on their own boilers.

The tamper-proof feature is the result of a fixed internal adjustment. This concealed adjustment prevents owners from tampering with the setting and is expected to materially cut down on unprofitable service calls. Incorporated in its design are convenient conduit outlets.

For more information, circle on Inquiry Chart, **Item 37**

# PRODUCT INFORMATION SERVICE

**Use the postage-free postcards below for further information on:**

- **News of Equipment and Materials**
- **New Catalogs**

**Circle the Item Numbers in which you are interested and print clearly your name and address with title.**

## NEW CATALOGS

**STEAM HEATING SPECIALTIES**

A folder on the line of steam heating specialties including thermostatic traps and air vents sold under the trade name Mouat, has been issued by The C. E. Squires Co., Cleveland, Ohio, which sometime ago purchased the Mouat Vapor Heating Company of that city. . **Item 38**

**MANUAL ON HOT WATER HEATING**

A revised and expanded engineering and installation Manual FCE-1251 is offered by H. A. Thrush & Co., Peru, Ind. The booklet contains 40 pages of simplified drawings, tables, wiring diagrams and examples relating to the various types of hot water heating systems. Design of one and two pipe forced circulation hot water heating installations is explained step by step with clearly presented reference tables. A complete section is devoted to radiant heating. Domestic water hookups are also covered. . . . . **Item 39**

**DUST COLLECTOR CATALOG**

The complete line of Torit dust collectors for production equipment is described in detail in a 24-page catalog issued by Torit Mfg. Co., St. Paul, Minn. Included are both cabinet and cyclone type dust collectors, in sizes ranging from ⅓ to 5 hp. Also shown are a complete line of fittings and accessories, and a series of blueprint sketches giving the over-all dimensions of each unit. . . . . **Item 40**

**WROUGHT IRON BOOKLET**

Proof by Performance is the title of an illustrated eight-page booklet released by A. M. Byers Co., Pittsburgh, Pa. It describes, in a non-technical manner, a number of installations in which wrought iron gave outstanding service over long periods of time. . . . . **Item 41**

**INDUSTRIAL FREEZERS**

Industrial mechanical freezers capable of producing and holding round-the-clock temperatures of as low as —165F are described in a condensed specification bulletin issued by Industrial Div., Webber Appliance Co., Inc., Indianapolis, Ind. It lists more than 45 standard models, ranging in cold chamber capacity from four cubic-foot testing and production models to 45 cu ft production models. . **Item 42**

**NEW V-BELT BULLETIN**

New improved Manhattan single groove V-belts are described in a Bulletin 6830B issued by Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J. . . . . **Item 43**

**NEW FILTER TEST METHOD**

Announcement of an improved method for testing air filter efficiencies is made by Farr Co., Los Angeles, Cal. Previously, filter efficiencies were determined by laboratory methods using a standard test dust. The new method tests each filter according to dust particle size. From the efficiency table thus obtained, the performance of any filter can be pre-determined for any operating condition. Engineers have long known that any air filter, regardless of its design, will operate at different efficiencies as the size of the dust particle varies. Previously-used laboratory testing methods gave only approximate filter performance data, it is claimed. This new method allows a filter user to buy the type filter which performs at the correct efficiency for the job to be done and possibly saves him the expense of installing equipment that is more sensitive than he requires. A technical booklet showing the equipment used and results obtained is available. . . . . **Item 44**

**COOLING COIL MANUAL**

Latest developments in extended surface cooling coils for use with direct expansion refrigerants and chilled water in air conditioning or process applications, are summarized in a revised bulletin, Cooling Coils, DS-365, 72 pages, published by The Trane Company, La Crosse, Wis. Included is a completely new coil, Type S, for use where water quantity is restricted, and a redesigned coil, Type OS, that can be completely drained where danger of freezing exists. Information is included on coils for gas cooling, butane vaporizing, transformer oil cooling, generator cooling and condensing of gaseous refrigerants. More than 50 pages are devoted to perfomance data, tables, selection and specifications. . . . **Item 45**

**WOOD AND STEEL TANKS**

An exceedingly comprehensive catalog of 48 pages has been issued by W. E. Caldwell Co., Inc., Louisville, Ky., and describing in considerable detail its line of tanks of wood and steel for every purpose, including round wood tanks, roof tanks of wood, tank foundations, rectangular wood tanks, field erected and shop built steel tanks, welded steel tanks, tower tanks, tubular towers, hemispherical tanks, together with information on piping, accessories, and tank heaters. Catalog is detailed in descriptive, dimensional and price information. . . **Item 46**

**HEAT EXCHANGERS**

An 8-page catalog describing its line of heat exchangers has been issued by Superior Combustion Industries, Inc., New York, N. Y. Catalog shows simplified drawings of the numerous basic designs for exchangers for the widest possible range of application for heating, cooling, condensing and evaporating in a manner which simplifies the selection and specification. Special attention is given to tank heaters and fuel oil heaters. . . **Item 47**

**OIL BURNING STEEL BOILERS**

Two 4-page bulletins on its steel oil burning boilers, one devoted to the fire tube type, the other to the water tube design, have been issued by the Atlantic Steel Boiler Co., Inc., Philadelphia, Pa. Folders show cutaway view that describes all the various features of the boiler together with capacity and dimensional data. The fire tube boilers are made in 12 sizes with capacities ranging from 400 to 3,840 square feet of steam radiation equivalent while the water tube boilers are made in three sizes with capacities of 418, 544, and 680 square feet of steam radiation. . . . . **Item 48**

**ROTARY PUMP FOR VISCOUS FLUIDS**

The Model A313B IMO rotary pump designed for handling petroleum products and other light viscous fluids such as used in steam atomizing oil burners, is described in Bulletin L313B issued by De Laval Steam Turbine Co., Trenton, N. J. . . . . **Item 49**

Postage Will be paid by Addressee

No Postage Stamp Necessary If Mailed in the U. S.

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 53, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

HEATING AND VENTILATING

148 LAFAYETTE STREET

NEW YORK 13, N. Y.

READERS' SERVICE DEPT.

## REVIEW OF SILVER MARKET

Demand for industrial uses of silver continues to grow, according to a Review of the Silver Market for 1951, issued by Handy & Harman, New York, N. Y. In spite of a sharp dropping off in demand for sterling by silverware manufacturers, approximately 110,000,000 ounces of silver were consumed in the arts and industries in the U. S., a drop of only 10,000,000 ounces, the report says.

The development in the Handy & Harman laboratories of low temperature brazing alloys and silver solders has brought about wide-scale use of silver in industry in recent years. The Review also points out that there is no apparent reason to fear that adequate supplies will not be available in coming months, even if defense spending is greatly stepped-up. .....**Item 50**

## CATALOG OF SPRAY NOZZLES

A new spray nozzle and accessory catalog No. 31 for use on industrial and air conditioning applications has been published by Delavan Mfg. Co., Des Moines, Iowa. It is designed as a guide to accurate selection of the proper nozzle or accessory for any type of application. The catalog also introduces a new line of swivel adapters. An alphabetical index of applications in the front of the catalog allows quick reference to the type or types of nozzles best suited for any specific job. Spray characteristics of each nozzle are described, and construction features are explained in detail. Dimension data is listed with explanatory illustrations. Complete performance ratings are charted for each size nozzle.....**Item 51**

## PACKAGED STEAM GENERATORS

Publication of the first complete architects' and engineers' manual on packaged steam generators has been completed by York-Shipley, Inc., York, Pa. This 208-page manual contains all the data required by an architect or engineer for laying out and writing specifications for boiler installations for applications requiring high pressure steam, low pressure steam, or hot water.

Included are color drawings showing application of and hook-ups, with specifications required for making the installation. Diagrams are also given of the piping requirements and connection sizes of each capacity steam generator. Another feature are electrical wiring diagrams and output charts.....**Item 52**

## TEMPERATURE CONTROL

Indoor-outdoor temperature control, the Weather-Flo, is described in a new 4-page bulletin, A751, issued by Automatic Devices Co., Inc., Western Springs, Ill. All details are given of construction and operation of this control which anticipates weather changes and adjusts heat input accordingly. Instructions tell how to adjust the temperature control when installing it and how to make any desired changes quickly without the need for engineering calculations. Sketch shows how control is installed .....**Item 53**

## HIGH PRESSURE AIR DISTRIBUTION

High pressure air distribution products are described in Bulletin 4960 published by Barber-Colman Co., Rockford, Ill. Bulletin includes typical information on noise levels and pressure drop, as well as helpful diagrams and a discussion of the application of the company's equipment to meet the requirements of high pressure installations. .....**Item 54**

## FUEL OIL HANDLING

A 20-page bulletin, No. 1644, entitled Storage and Handling of Heavy Fuel Oils, has been issued by Preferred Utilities Mfg. Corp., New York, N. Y. The problem of storing and handling heavy fuel oils is discussed at considerable length together with illustrations showing different types of systems for heating heavy oils, including electric systems and heat exchangers.....**Item 55**

## SAFE CONSTRUCTION PRACTICE

A 60-page manual, 25E7524, published by Allis-Chalmers Mfg. Co., Milwaukee, Wis., is available to people concerned with safe and correct work practices in the maintenance and construction fields. Contents contain a description of general standards, general rules for overhead work and excavations, safety rules for millwright and machine repair work, for electrical maintenance, and for plumbing and steamfitting, along with rules for outside contractors...**Item 56**

## HEATING AND PLUMBING PRODUCTS

A 24-page catalog, "Products for the Plumbing and Heating Industry", Form IN-57A, is announced by Johns-Manville, New York 16, N. Y. It covers insulations, refractories, packings and gaskets, and asbestos-cement pipe of particular interest to the trade. On each product presented there is a close-up photograph of the material under discussion and drawings or photographs that demonstrate application. Text gives pertinent physical properties and descriptive information. Size and packaging data are conveniently tabulated on each product.....**Item 57**

## ALLOY STEEL WELDING FITTINGS

Bulletins KS-1-52 on its Key-Kast alloy steel welding fittings is available from Key Co., East St. Louis, Ill. These fittings are based on an entirely new design of greater wall thickness throughout for increased structural strength and extra thickness at critical areas for greater allowance against erosion and corrosion. Advantages this new design principle offers for alloy piping systems are explained graphically in the bulletin, and the various alloys available are also listed. .....**Item 58**

## PIPE INSULATION LINE

Bulletin G-11, just announced, is a four-page catalog picturing, describing and listing specifications for six of the Lasco products manufactured by the Lynch Asbestos Co., Los Angeles, Calif. These include aircell pipe covering, wool felt pipe covering, foil anti-sweat pipe covering, anti-sweat pipe covering, foil insulation and abestos paper...**Item 59**

## PACKAGED HEATING SYSTEM

Information concerning design, construction and operation of The National Packet, an all-in-one heating plant comprising boiler, burner, controls, domestic water heater and accessories, is presented in Catalog 595 available from The National Radiator Co., Johnstown, Pa. The 8-page catalog pictures the component parts of the package, such as the water temperature control, circulating pump, stack switch, domestic water heater, combustion chamber and insulation. Ratings and specifications for flush jacket and enclosing cabinet models are presented. Complete roughing-in dimensions are supplied. Listings are given of both standard and alternate equipment furnished with package. .....**Item 60**

## BOILER SETTING MANUAL

Those concerned with boiler operation and maintenance will find reference material in a 24-page catalog and data book entitled, Boiler Settings with Plastic and Castable Refractories, issued by Ramtite Co., Div. of S. Obermayer Co., Chicago, Ill. It contains cross-sectional drawings, charts, technical illustrations, and other data in the field of plastic and castable refractories and their applications in modern boiler settings. It also presents information about refractory design and installation.....**Item 61**

## STAINLESS STEEL COATING

A 4-page bulletin on its stainless steel coating for metal surfaces has been issued by Steelcote Mfg. Co., St Louis, Mo., and describes the stainless steel coating made by the company to solve severe corrosion problems and to resist oils, grease, acids and petroleum derivatives. The coating is made for either spray or brush application. .....**Item 62**

## BLOWER TYPE UNIT HEATERS

Selection and application of Trane Torridor blower type unit heaters are explained in a revised 56-page catalog, DS-327-A, published by The Trane Co., La Crosse, Wis. This condensed bulletin provides capacity information and performance data on units with capacities from 100,000 to 1,500,000 Btu per hour. Models described in the bulletin deliver heat from floor, wall or ceiling, directly or through ducts. The bulletin graphically shows 10 different outlet arrangements, optional dampers, mixing boxes, etc. .....**Item 63**

**PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 1 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 1 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 1 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 1 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 1 | 62 | 63 | | | | | | | |

Mar. H/52

**PLEASE PRINT**

Name .....

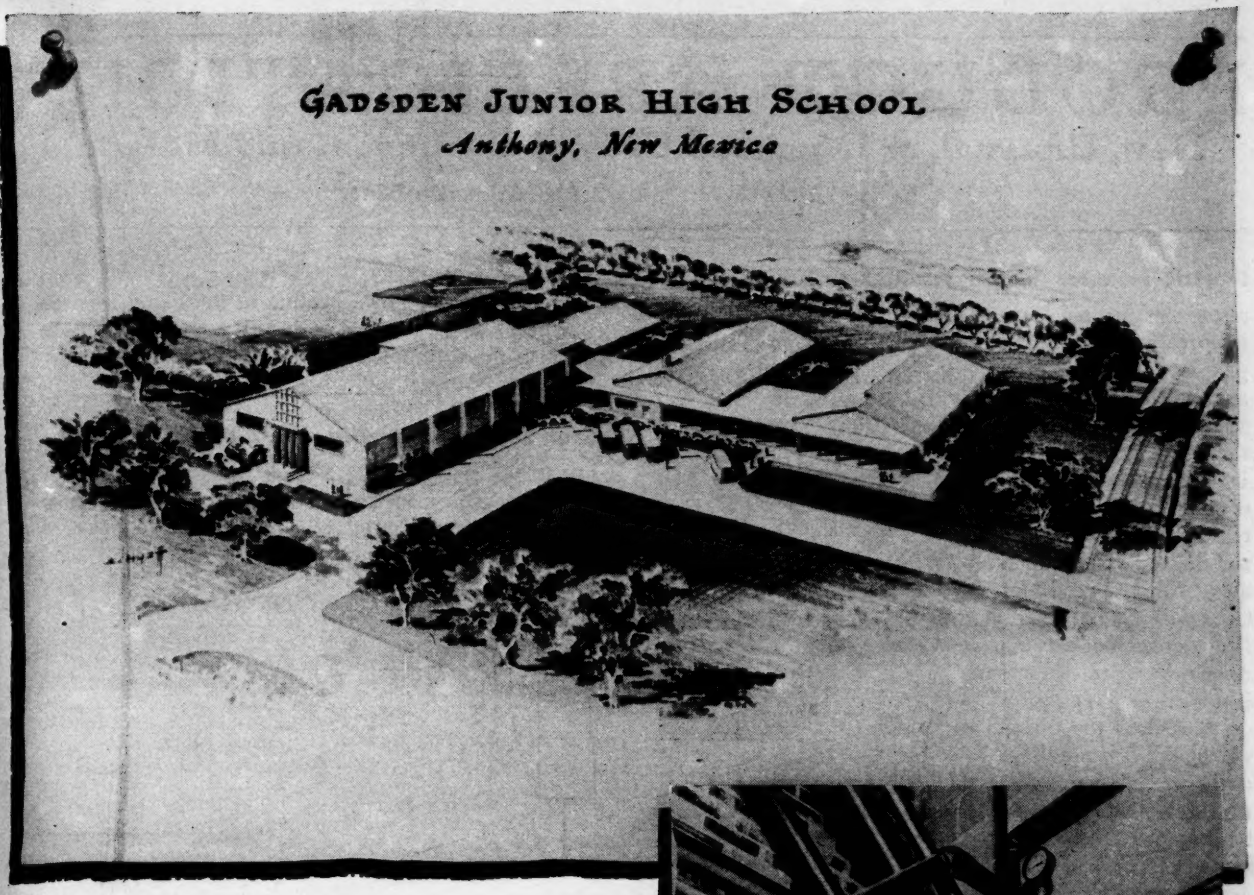
Title .....

Firm .....

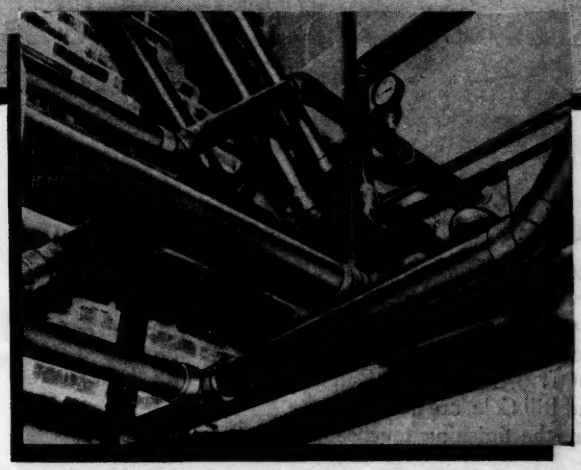
Street .....

City .....Zone....State.....

This card is void after June 1, 1952




# ANOTHER CASE OF COPPER where it counts!



Although the newest, most modern design and construction techniques are used to create buildings like the Gadsden Junior High School, it's the materials that have been tested and proved over the years that are entrusted with the important jobs.

That's why 13,000 feet of Revere Copper Water Tube were used for the hot and cold water lines . . . in the heating system . . . and as vent stacks in the Gadsden Junior High. Centuries of use have proved copper endures. Revere Copper Water Tube is non-rusting and comes in straight lengths of 12′ and 20′ as well as 60′ coils to suit every type of installation. The longer length can be bent to save fittings. The solder or compression fittings used with Revere Copper Water Tube make it possible to use a thinner wall tube than when threaded fittings are used, resulting in a substantial saving in metal and easier workability in inaccessible places.

Supplies of Revere Copper Water Tube may necessarily be limited, but, remember: you can still use it for underground service lines, domestic hot and cold water lines, industrial processing and for gas equipment. See your Revere Distributor. He will advise you of the availability of materials and, if you wish to discuss technical problems, will put you in touch with Revere's Technical Advisory Service.

*"WE ARE PROUD OF the amount of building we procured for the price," said Mr. Rex F. Bell, Superintendent, Gadsden Independent Schools, when he inspected the newly-completed Junior High at Anthony, New Mexico. Architect—Truman J. Mathews, Santa Fe, N. M.; Consulting Engineers—Davis & Foster, El Paso, Texas; General Contractor—Gilchrist Const. Co.; Plumbing Contractor—Ruiz Plumbing Co., Inc., both of Las Cruces, N. M.; Distributor—Momsen Dunnegan Ryan Co., El Paso, Texas.*

*(insert photo) IDEAL FOR TIGHT SPOTS LIKE THIS—Revere Copper Water Tube takes up less space than bulky, threaded pipe and the fittings used do not require a lot of room for swinging a wrench. Tube sizes used range from ½" to 3" in diameter.*

**REVERE**

**COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*

230 Park Avenue, New York 17, N. Y.

• • •

*Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere*

**SEE "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY**

# PRODUCT APPLICATIONS

## New, Unusual, or Ingenious Uses of Equipment and Materials

Conducted by WM. B. FOXHALL, Associate Editor

### Electric Heaters Warm Airliner Coffee

**PROBLEM:** United Airlines found that maintaining proper temperature of soup, water and coffee in spite of altitude pressure changes during long flights posed a problem in safe and sure heating methods.

**SOLUTION:** A new type of hot beverage container currently being used aboard United's DC6 Mainliners employs a General Electric 28-volt, 50-watt Calrod heater which operates without need for thermostatic control. Previous methods, using resistance wire heaters insulated between sheets of mica, had the disadvantage of depending on a thermostat for control and was difficult to clean.

**RESULTS:** Soup, water and coffee, heated almost to the boiling point before being put into the containers, are kept at proper drinkable temperature by the Calrod heaters in spite of altitude pressure changes for the duration of the longest flights.

### Student Architects Build Home

**PROBLEM:** Four senior architectural students at Carnegie Tech decided to see what they could learn by building a house. One of the main features of the house was to be a closely controlled radiant heating system.

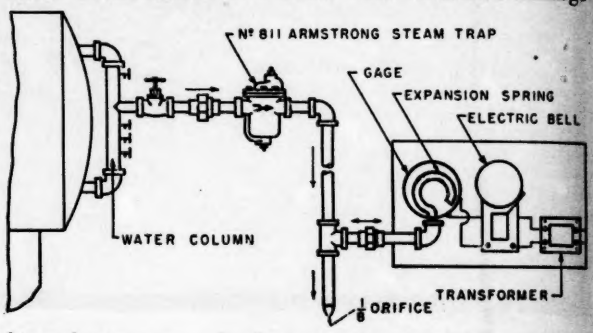
**SOLUTION:** The four, Ralph Burt, Alva Hill, Don Garrett and Bill Cole, are now putting the finishing touches on a three-bedroom redwood and brick house on the outskirts of Pittsburgh. They have erected the house almost without assistance. The house is built in four levels. One of the unusual features is a radiant heating system which is a ceiling installation in the raised bedroom wing and a floor installation in the lower levels. A. M. Byers' wrought iron pipe for the radiant heating system is embedded under the 4-inch concrete floors in the lower levels. In the bedroom, the pipes are suspended from the ceiling joists. Pipes nearest outside walls are on 6-inch centers while internal pipes are on 12-inch centers. The heating system is divided into three zones. One serves the bedroom wing, one serves the kitchen, dining room, entry, garage and storage room, and the third is restricted to the living room.

**RESULTS:** Alva Hill, who designed placement of controls for the system, says, "The idea originally was to make it possible to cut down heating in the living room when the fireplace is going. We just went on from there to provide more complete control."

### Steam Trap Operates High Water Alarm

**PROBLEM:** To construct a high water level alarm for a boiler using a steam trap and pressure gage.

**SOLUTION:** A No. 811 Armstrong steam trap was connected at the desired level of the water column. Discharge from the trap was piped to actuate a pressure gage, the expansion spring of which was arranged to close a contact which was in series with an electric circuit operating a bell.



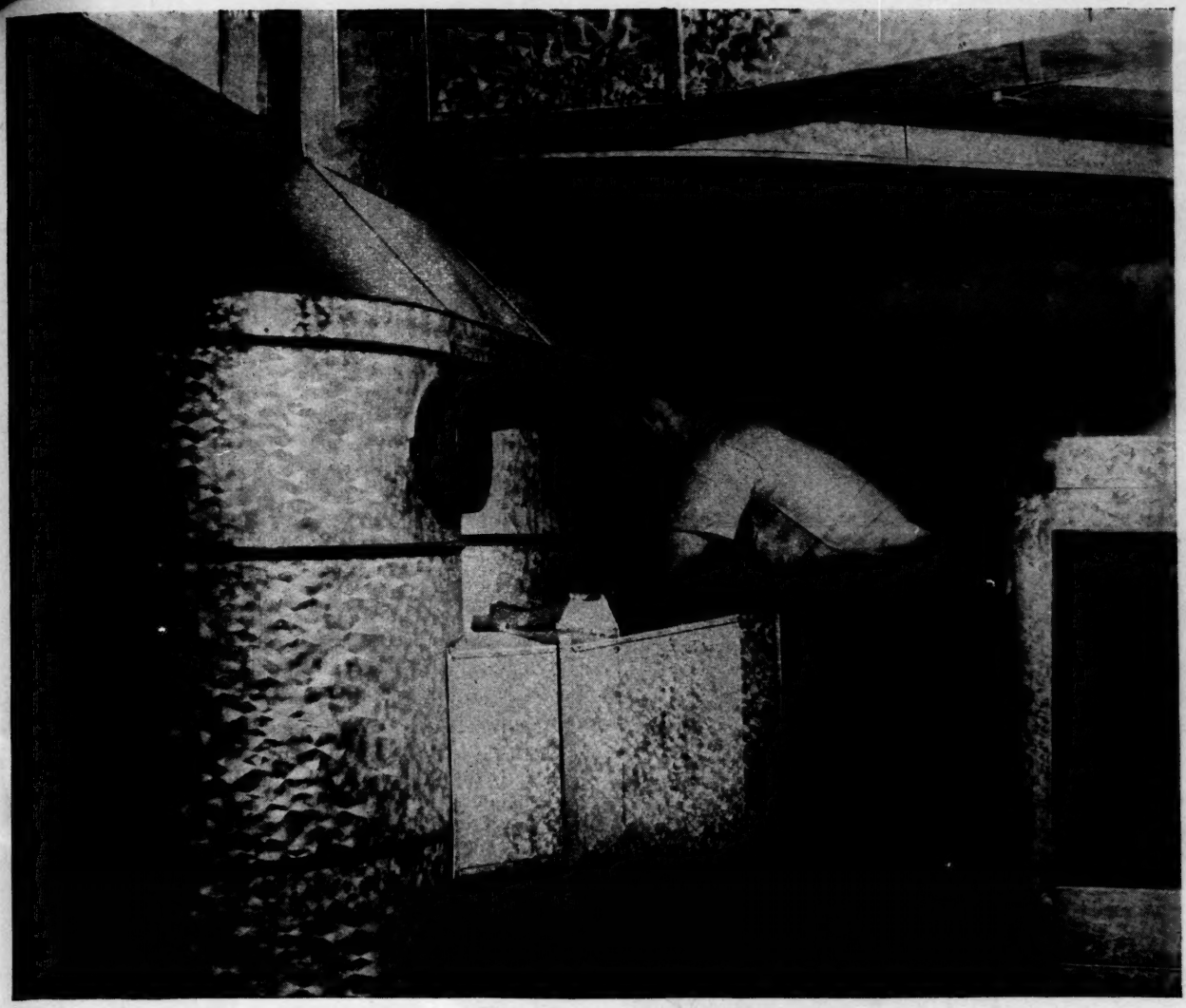

**RESULTS:** When the water level in the boiler rises too high it fills the trap from which it is discharged to the actuating gage, which makes an electrical contact, which rings the bell.

### Apartments Radiant Heated

**PROBLEM:** To conserve floor space and improve comfort characteristics of heating in the Kings Arms apartments, in Columbus, Ohio, radiant heat with automatic control was specified.

**SOLUTION:** Ceiling coils of copper-coated steel tubing were installed in each of 31 buildings in the group, totalling 180 apartments. Each building is heated by a single boiler with a Janitrol gas fired burner. Each apartment is equipped with a thermostat which controls the pump circulating hot water through ceiling tubes.

**RESULTS:** Comfort of each apartment is assured. Economy of operation results from a 79% burner efficiency measured on the job. Radiant heating helps rent apartments, according to the building owner. Heating plants were installed for less than $500 per unit.



# The LOW-COST SHEET
# *is Galvanized Steel*

When you compare galvanized sheet steel with other metals on the basis of equal strength, you will find a substantial difference in cost. Other metals must be used in relatively thick and expensive gages to equal the strength and stiffness of steel in comparatively light gages.

Or, if you compare galvanized steel with other metals in equal weights – you will see that steel is again priced lower.

Bethlehem Galvanized Sheets are made from strong, durable steel, either plain or copper-bearing, and are coated with Prime Western zinc for good corrosion-resistance. They are easy to handle without kinking, they have excellent workability, they give a finished look to any job.

**Bethlehem**
***GALVANIZED***
**Steel Sheets**

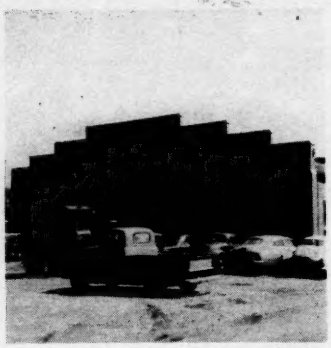
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

**On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation**

***Export Distributor:*** **Bethlehem Steel Export Corporation**

### Sewer Gas Used for Space Heating

**PROBLEM:** The city of Austin, Minn., had trouble with the heating system of a municipal garage located at the sewage disposal plant. The building, of brick and steel construction, has a floor area of approximately 7600 sq ft and houses the city's trucks and heavy road equipment. Small suspended unit heaters proved inadequate to cope with conditions imposed by an unusual fuel condition and temperature variations brought about by frequent opening of large doors. The main problem arose from use of sewer gas for firing the unit heaters. This gas caused serious trouble because of its high sulfur content which corroded the combustion chambers of the small heaters.

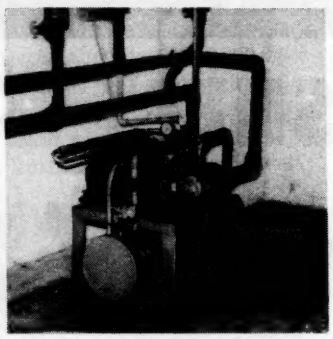


**SOLUTION:** A Dravo Counterflo heater was installed in an inverted position in the roof trusses.

**RESULTS:** A high alloy stainless steel combustion chamber has given trouble-free operation since 1947. High capacity of the heater, with automatic control, is able to handle heavy intermittent loads.

### Central Water Cooling Replaces Units

**PROBLEM:** The National Medical Center, Bethesda, Md., wished to provide a dependable drinking water system to a three-story wing of its hospital for convalescent naval personnel. Originally three separate self-contained storage coolers had been used. Each had its own condensing unit, circulating pump, expansion valves etc. Coils in all units had developed leaks and were unserviceable.



**SOLUTION:** To thoroughly and efficiently chill the drinking water, an Acme RC-23 Flow-Cold Liquid Chiller was selected. This single, packaged unit replaced all three of the previously installed self-contained units and was hooked up to the existing system.

**RESULTS:** The system now serviced by the single Flow-Cold has been completely successful in furnishing cool drinking water. Because of its compactness, two-thirds of the space occupied by the original equipment was saved. The results were so satisfactory that a second unit was purchased for a similar application in another section of the center.

### Special System Heats Gymnasium

**PROBLEM:** In the basement of the Ramaz School in New York City, 345 pupils from kindergarten through sixth grade use gymnasium facilities at irregular intervals during the day. The room was formerly heated by steam radiators along the perimeter near the ceiling, with fresh air provided through the windows. This system had the disadvantage of heavy losses to the ceiling, long warm up periods, and severe drain on the building's limited steam supply. Since the gym was not in continuous use, a more flexible and economical system was called for.

**SOLUTION:** A compact air handling unit with an unusual control system for providing an abundance of filtered fresh air was installed. In planning the new system, it was necessary to choose equipment which would fit into a 4-ft deep storage area in the wall of the gym. A 10,000-cfm upright air handling unit manufactured by U. S. Air Conditioning Corp., containing fan and filters as well as steam coils in a single compact casing was selected. For fresh air, a duct was run up from the unit to the exterior of the building. The supply duct was taken between the overhead beams to a special diffuser in the center of the ceiling. This duct will be concealed by a new flat ceiling so that the only visible evidence of the system will be the diffuser. A specially designed control system provides 100% fresh air when the outside temperature is above 65 F. As the outdoor temperature drops, the intake louver gradually closes to a minimum of one-third fresh air at 58 F. As the temperature goes below this point, the steam valve begins to open, providing only that amount of steam necessary to produce whatever room temperature is required. The diffuser delivers air directly to the breathing level and return air is taken directly back to the unit at floor level.

**RESULTS:** Since only the air itself is being heated and there is little loss to the ceiling, the system operates very efficiently and can ready the gym for use in 15 minutes. Drafts from open windows are eliminated.

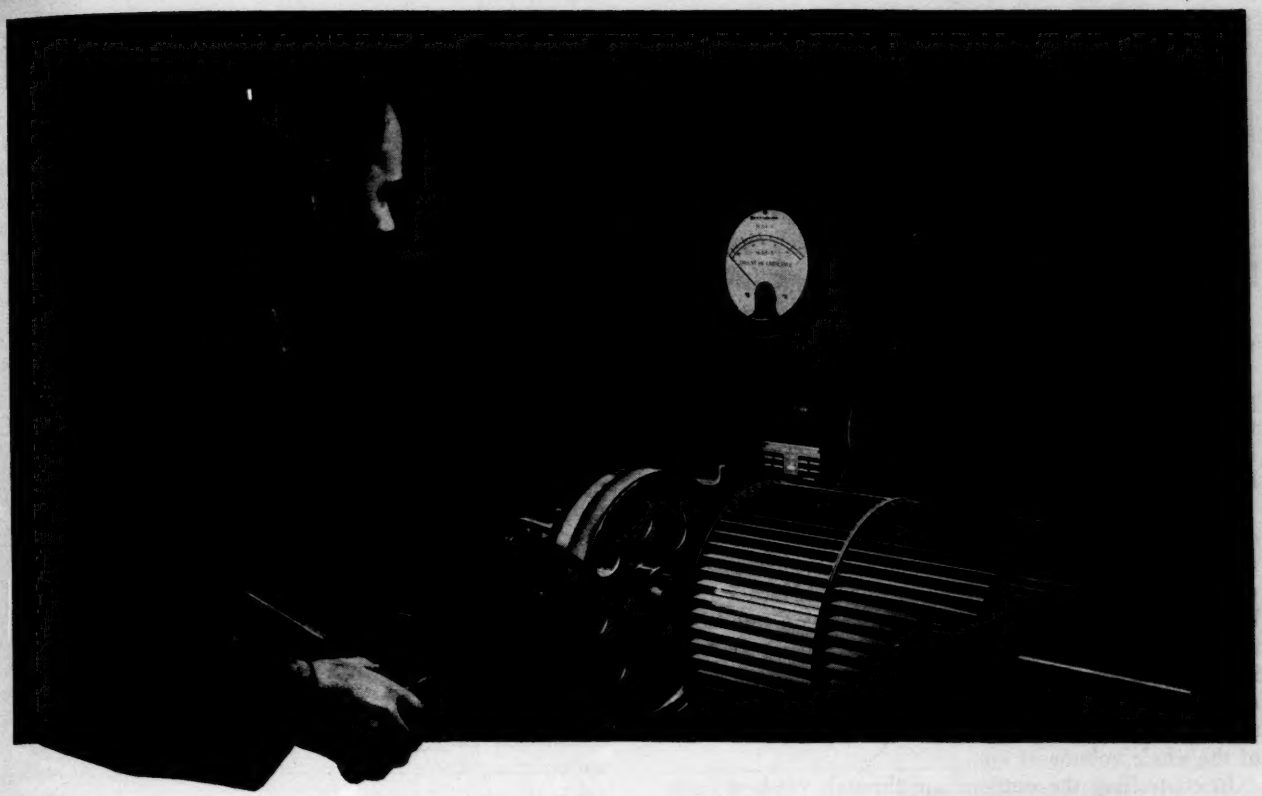
### Lightweight Concrete Aids Perimeter Heating

**PROBLEM:** Perimeter warm air heating was specified for the Catholic Church of Marseilles, Ill. In order to insure maximum efficiency, it was necessary to insulate the ductwork in the concrete slab.

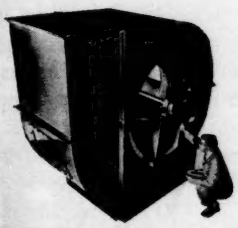
**SOLUTION:** Three to four inches of Coralux (perlite aggregate product of F. E. Schundler & Co., Inc.) concrete was poured first over a vapor barrier laid under the proposed pipe position. The poured material was curved up four inches on the sides. No forming was necessary since Coralux is a plastic mix that can be placed up on slants with hand tools.

The pipe was laid next day and an outside form was then constructed. Coralux was poured up to four inches thickness over the pipe. Material was allowed to dry for two to three days and was then surfaced with two inches of conventional cement.

**RESULTS:** No surface cracks, shrinkage or expansion pressure have been observed. The Coralux adheres to the shape of the pipe and needs no additional structural support. No delay in the construction was necessary by requiring insulation men on the job to wrap pipes; it was completely a cement job. Air discharged through perimeter openings to church steps retained sufficiently high temperature to assure comfort.



# Hairline balance cuts vibration in TRANE fans



When TRANE engineers set out to balance TRANE Fans, they insisted on such exacting precision that two more major TRANE Fan advantages were created. Ultra-modern electronic machinery, for dynamically and statically balancing fans, was tailor-made to TRANE requirements. Balancing procedures were worked out so carefully that the tolerance permitted between wheel centerline and the center of gravity of the wheel is equal or less than the infinitely small space needed to slip the hub over the shaft. Thus TRANE Fan balance is as accurate as the fit of the hub to the shaft.

This hairline balance cuts vibration of TRANE Fans to an irreducible minimum. That's advantage Number One. As a result, fan bearings, the only point of friction in a fan, last much longer. And TRANE Fans, large as well as small, can be installed anywhere in the building without danger of damage due to vibration. Advantage Number Two is less noise. As vibration is eliminated, noise, too, is reduced.

Besides less vibration and lower noise levels, other TRANE Fan features include rugged construction for long life—streamlined air inlet that moves more air with less power—more accurate fit and tolerance for consistent performance—chlorinated rubber base paint finish to prevent corrosion.

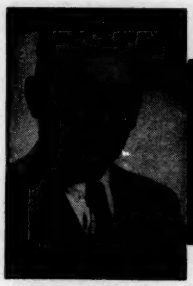
TRANE Fans are available in Class 1 and 2 construction for many applications. They are particularly valuable when combined with TRANE Cooling and Heating Coils for a complete central air conditioning system. In TRANE Coils, the streamlined fin-and-tube and the smooth TRANE Fin offer minimum resistance to air flow. This low air friction and higher efficiency of TRANE Fans produce better performance with lower horsepower consumption. For more details concerning TRANE products, contact the TRANE sales office nearest you.

*Special machines, built for TRANE (left), balance large fans both statically and dynamically. Above is a balancer for smaller size wheels.*

TRANE

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
Trane Company of Canada, Ltd., Toronto
Offices in 80 U. S. and 14 Canadian

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT



# Experience is my Classroom

By T. W. REYNOLDS

**• NON-CIRCULATION AND FREEZING IN LONG COILS**

Coils over 6 ft long sometimes have their troubles, especially where operating and physical conditions gang up most disadvantageously. An example is where a high internal heat gain requires considerable outdoor air at low temperature.

I have seen coil louver dampers blocked off in parts, coils changed from horizontal to vertical, and steam and return connections changed from opposite ends, to both on the same end, and still troubles would persist. Partial heating of a coil will cause air stratification and some occupied areas may then be too cold. Temperature stratification can also come about when by-passing unheated air or when the steam supply to ordinary surfaces is modulated. The control point may not be representative of the whole volume of air.

In controlling the outdoor air through pre-heat coils one should first use a distributing or non-freeze type of coil. If the coils must be banked above each other to secure sufficient surface for the quantity of air to be heated, a separate temperature control should be placed on the leaving air side of each section of coil. This will produce a fairly even air leaving temperature from all coil sections thus reducing to a minimum the possibility of stratification and freezing, even where the coils are of the distributing type. This separate control at each coil section has the further advantage, where return and outdoor air are mixed, of throttling the valves on suctions of coils handling return air more than the valves on suctions of coils handling outdoor air, thus keeping the total temperature of air entering the fan more even throughout the entire casing. With separate controllers, it matters not whether coils are fed all from one side or staggered so that they are fed first from one side and then from the other.

Mixtures of return and outdoor air should also have the cold air brought in more at the top and the warm air at the bottom, thus giving a natural gravitational mix. A mixture stat should be used only when really necessary and then it should be located a considerable distance down stream from the fan. Obviously, with any measure of reheat coil, this will result in a blow-through system; however, from the viewpoint of a good control, it cannot be helped.

Face and by-pass dampers sometimes have their limitations. As a rule, they do prevent definite stratification.

**• STANDARDIZATION**

Standardization results in fewer sizes and in production of more of the same thing. Hence it results in lower inventory and purchase costs, better workmanship, easier inspections, simplification of service and maintenance, and better stocking of parts. It also provides more effective managerial control and less details for executives. There are fewer decisions to be made on product, less conferences, and fewer controversies or squabbles with customers.

Boilers, for example, can vary in minor details, but the basic structure of many can be standardized. Their fuel units should be capable of flexibility in fuels used, since kind of fuel varies to some extent with locality and seems to be ever changing even in the same area.

In some applications, air conditioning can be standardized. Certain rule of thumb calculations, such as the number of occupants in a theater are apt to give more accurate results than detailed calculations to suit each installation. Basic calculations for design and the determination of equipment sizes could be standardized for such applications.

**• ON THE SPOT PHOTOS**

Photographers are exceedingly valuable in construction, particularly to refresh a memory that has been dimmed. While they may be helpful for the job 20 miles distant, they are badly needed for the job 2,000 miles away. They eliminate the endless discussions that follow because of a bad memory, avoid the telegrams that must be sent for additional information, and eliminate the risk taken when one gambles on a guess.

On the photographs one can mark measurements, indicate pipe sizes and designate services and equipment. Prints can show the location of each valve, flange or specialty.

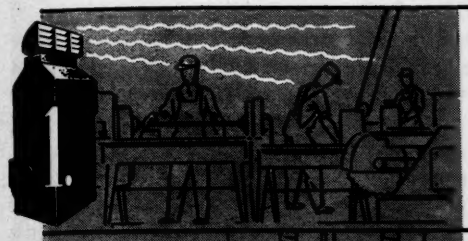
Photographs make a report so much more understandable and with fewer words. They make excellent progress pictures and when posted on the wall alongside the drafting board, they will be referred to many times. There is no need to puzzle over some obliterated pencil sketch that was made under some trying condition. The use of a camera will make it easier to gather the necessary information on a job and in less time.

What kind of camera should be used? Large cameras are bulky and cumbersome to handle. Reflex type cameras which permit one to see the exact picture that is being taken, are particularly helpful to one who has difficulty in setting the proper focus for the picture. There are a large number of small cameras on the market with lens systems that have a large depth of focus to insure sharp pictures. These are easy to handle, not too difficult to operate, and although negative area is small, large size prints can be ordered when the film is developed. Regardless of the type camera used, by all means use photographs for an indisputable record of a job.

# HERE ARE 5 ways

# A DRAVO *Counterflo* HEATER* CAN WORK FOR YOU!

*DIRECT-FIRED




## COMFORT HEATING (commercial and industrial)

Dravo Heaters have a 150-foot air throw and recirculate warm air at the working level, giving maximum comfort with minimum roof heat loss. No expensive pipe covering, radiators or ducts required. Quick warm-up; automatic on-off or modulating controls.

## TEMPERING MAKE-UP AIR

Where dust-filled or fume-filled air must be removed from a building by exhausters, this air can be replaced and tempered by Dravo Heaters. Equal pressure is maintained . . . working conditions are kept comfortable.

## HEAT CURING

Dravo Heaters can be used independently or in combination with other equipment for process curing concrete, plastics, paper, fibre containers, rubber and many other products. Automatic temperature controls keep air flow at desired temperature.

## PROCESS DRYING

Moisture content of air can be controlled or removed entirely by using fresh or recirculated air. Immediate response to temperature controller demand makes it ideal for drying paint, farm crops, wood products, rugs (after cleaning) and many other processes.

## YEAR-'ROUND VENTILATION

In addition to comfort heating, Dravo Heaters provide fresh-air ventilation in warm weather and can be easily tied in with air-conditioning systems.

**DRAVO HEATER *Plus* VALUES . . .**

- Low initial cost . . . users report 30% to 60% savings on installation.
- Direct-fired . . . low fuel consumption . . . burn gas or oil . . . readily converted.
- Long service life, low maintenance . . . stainless steel combustion chamber eliminates refractory lining.
- Easily moved to any location to fit your requirements.
- Flexibility . . . can be mounted horizontally or vertically on floor, walls or ceiling.

**WRITE FOR MORE INFORMATION.** It's worth your while to look into Dravo *Counterflo* Heaters for any of these five functions shown above. You'll be glad you did. Ask for Bulletin No. ST-52

**DRAVO CORPORATION**

**HEATING DEPARTMENT**
Dravo Bldg., Fifth & Liberty Ave.
**PITTSBURGH 22, PA.**

ATLANTA • BOSTON • CHICAGO • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH

*Sales Representatives in Principal Cities*

DRAVO

Manufactured and sold in Canada by Marine Industries, Ltd., Sorel, Quebec

Export Associates: Lynch, Wilde & Co., Washington 9, D.C.

# Abstracts AND Reviews

*Publications abstracted in this department should be ordered direct from publisher.*

## EXHAUST HOODS

For information on exhaust hood design, Exhaust Hoods, by J. M. DallaValle is the primary source of data, based on the author's own experimental investigations, on the flow of air around and into the openings in exhaust ventilating systems. Backed by over twenty years' experience in the field of industrial hygiene, it is a concise assembly of both fundamental theory (including the latest thinking along the lines of what is known as the dilution concept) and of practical applications of theory to the actual design of hoods for all types of industrial installations. Originally published as a series of reports of the author's extensive research into the subject, the basic material has been considerably expanded, in this new second edition, and has been coordinated with data by other investigators covering all phases of hood, booth, and slot design.

Increased emphasis on industrial health hazards in plants where harmful and dangerous dusts, vapors, gases or fumes are generated has resulted in a demand for accurate design of exhaust systems, of which the hood is a most critical part. In Exhaust Hoods, four chapters are devoted to the various aspects of theory, including flow of gases, velocity characteristics of canopy hoods, and criteria for determining hood effectiveness. Five chapters cover actual hood design for various types of applications. Other chapters cover booth-like structures, grille openings, woodworking machinery, examples of hood design calculations, entrance losses, and the essentials of good construction. Sample problems, with the solutions worked out in detail, are given in a chapter devoted entirely to this matter. Mr. DallaValle is professor of Chemical Engineering, Georgia Institute of Technology.

*Exhaust Hoods, by J. M. DallaValle, 141 pages, 127 illustrations, 30 tables, bound in fabrikoid, The Industrial Press, 148 Lafayette St., New York 13, N. Y. Price, $3.50.*

## PIPING DESIGN AND ENGINEERING

Into one volume has been brought together a large amount of information helpful to the engineer engaged in the design and application of pressure piping systems. Piping Design and Engineering gives a broad coverage to the various phases of these subjects and it also contains considerable material never previously published.

Chapter 1, a 67-page chapter on Expansion and Stresses, was prepared by S. W. Spielvogel, assistant division engineer, Mechanical Engineering Department, Consolidated Edison Company of New York. The other chapters were written by members of the engineering staff of the Industrial Piping Division, Grinnell Co., Inc.

Subject matter is arranged in the following chapters: expansion and stresses, velocity and pressure drop, pressure-temperature pipe graphs, metallurgical briefs, piping materials, pipe fabrication, pipe hangers and supports, and general tables. The latter chapter of 38 pages contains a group of tables of value to the piping engineer.

The material is well arranged, the illustrations are clear and the graphs are large enough to be read without difficulty. It should prove an excellent reference volume.

*Piping Design and Engineering. Cloth bound, 8½ x 11 inches, 223 pages. Published by Grinnell Co., Providence, R. I. Price, $10.*

## INDUSTRIAL VENTILATION

Engineers interested in the design and installation of industrial exhaust systems will find practical information in Industrial Ventilation, which has now gone into its second edition, although there are no basic changes when compared with the first edition. This manual of recommended practices is published by the American Conference of Governmental Hygienists. The manual has over 500 drawings to help explain and clarify data for the reader.

The book covers general principles of ventilation, dilution ventilation, comfort ventilation, hood design, duct design, make-up and recirculated air, construction specifications, testing of ventilation systems, fans, and air cleaning devices.

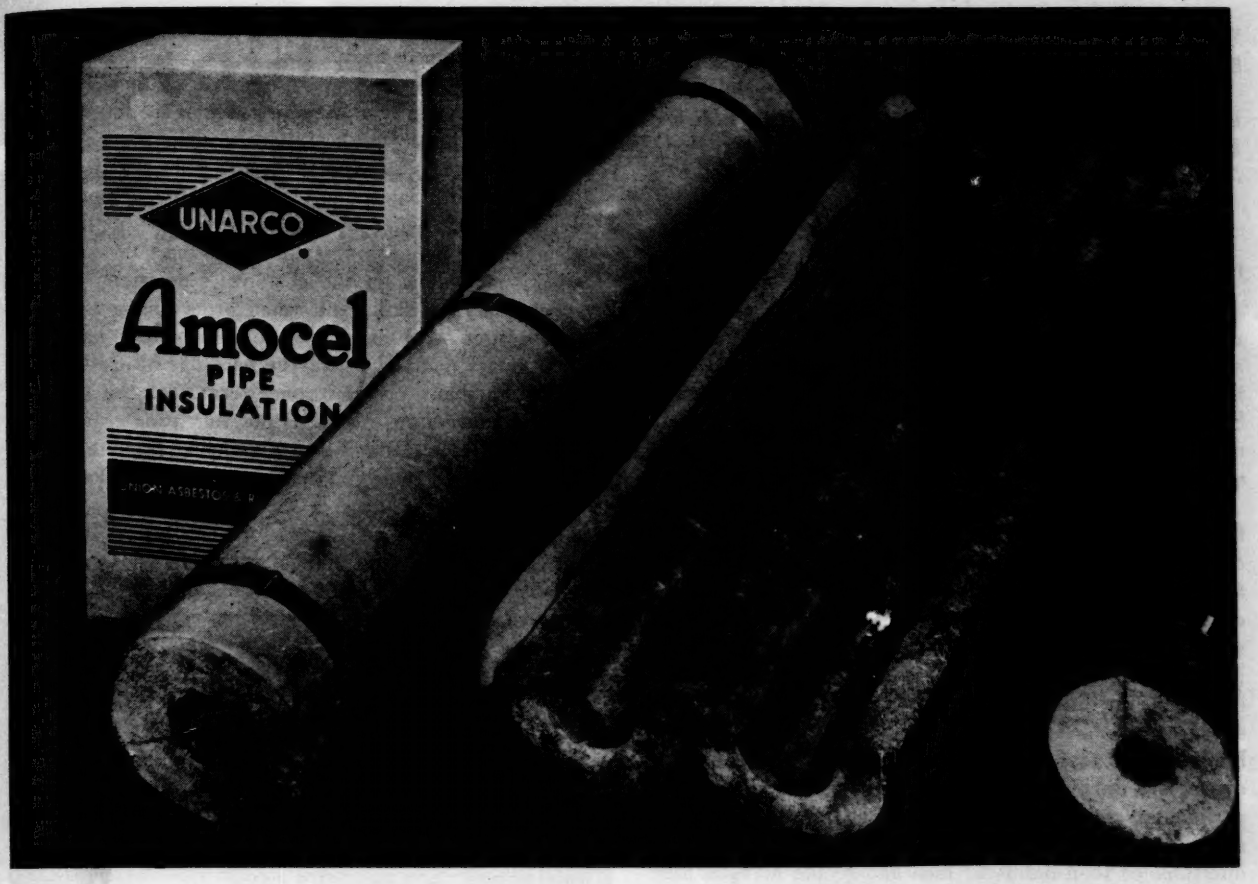
*Industrial Ventilation—wire bound manual. Published by American Conference of Governmental Industrial Hygienists, P. O. Box 453, Lansing 2, Michigan. Price, $3.*

## THE ENGINEERS' ILLUSTRATED THESAURUS

While many are acquainted with Roget's Thesaurus of English Words and Phrases, the idea of having a thesaurus for the engineer which would illustrate machine design and basic machine parts may seem most unusual. Herbert Herkimer, during his many years in the engineering field has collected engineering drawings, sketches, diagrams and abstracts from many foreign and domestic sources from which he has drawn for his Engineers' Illustrated Thesaurus. It contains 8,000 detailed designs and drawings of mechanical movements, parts, devices, tools and assembled machinery. These have been classified and arranged for easy reference under such general classifications as basic mechanical movements, combustion, prime movers, etc.

As he points out, the most complicated mechanisms consist merely of combinations of the six fundamental machines: Pulley, wheel and axle, inclined plane, wedge, screw and lever. The author's claim to originality lies in his methods of arrangement and indexing for ready, rapid reference.

Every conceivable type of machine element is identified and where necessary, there is an explanation of the method by which it accomplishes its particular function. The basic




# YOU PAY NOTHING EXTRA FOR UNIBESTOS-TYPE Amocel

## ...THE MAINTENANCE-SAVING PIPE INSULATION

Amocel for commercial uses—like famous Unarco higher-temperature Unibestos—is made from strong, resillient Amosite, the amazing African asbestos. Designed for temperatures up to 600° F., it's a premium product in every way—clean appearance, long life, high efficiency—and it's easy to fit so you save from the first with this better insulation. Made in standard, 1½", and 2" thicknesses for pipe sizes from ½" to 12" in half-rounds with jacket and metal bands. Your Unarco Distributor has Amocel. Call him or write for literature.

- UNHARMED BY MOISTURE, STEAM, OR FUMES
- LIGHT, STRONG—WITHSTANDS IMPACT AND VIBRATION
- MAY BE REMOVED AND REUSED REPEATEDLY WITHOUT DAMAGE OR LOSS OF EFFICIENCY

UNARCO

## UNION ASBESTOS & RUBBER COMPANY

DEPT. B-3, 332 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS

value of the book lies in its many illustrations which are grouped for their suggestive value.

*The Engineers' Illustrated Thesaurus, by Herbert Herkimer. Cloth bound, 5½ x 8 inches, 572 pages. Published by Chemical Publishing Co., 212 5th Ave., New York, N. Y. Price, $6.*

## NUTRITION AND CLIMATIC STRESS

While the engineer realizes the importance of climate to the well being of the individual, and the use of housing and clothing to help man adjust himself to heat and cold, the subject matter covered in Nutrition and Climatic Stress with Particular Reference to Man presents one side of the problem with which he undoubtedly is not acquainted.

Many biochemical and engineering investigations of food stability and preservation under different conditions of temperature and humidity and of proper packaging and transportation, were undertaken under the stimulus of the war effort. Experimental air conditioned chambers and decompression chambers were used in most of the investigations reviewed. However, the simulation of living conditions in different climates in restricted quarters is never complete. The diurnal variations in temperature, humidity, air motion and insulation, both direct and indirect, are difficult or impossible to duplicate in an experimental chamber. In checking laboratory tests with actual field tests before practical conclusions are drawn, questions of food habits of men and of the acceptability of proposed dietary measures are of the greatest importance.

Authors of this book are H. H. Mitchell, professor of animal nutrition, University of Illinois, and Marjorie Edman, research assistant in animal nutrition in charge of literature survey, University of Illinois.

The book has chapters on diet in a cold environment, diet in a hot environment, diet at an altitude, and practical considerations.

*Nutrition and Climatic Stress, with Particular Reference to Man, by H. H. Mitchell and M. E. Edman. Cloth bound, 6 x 9 inches, 234 pages. Published by Charles C. Thomas, Springfield, Ill. Price, $6.75.*

## SELLING EQUIPMENT

Engineers who sell, whether for a large industrial company or as a manufacturer's representative, who want to improve their method of finding, contacting, selling and servicing industrial customers, will find much of value in the pocket size book, Selling to Industry, by Bernard Lester. The author has served as sales executive for Westinghouse Electric Corp., consultant on machinery and equipment marketing and selling, and as lecturer on sales engineering and marketing at the University of Pittsburgh, Stevens Institute, and Brooklyn Polytechnic Institute.

The author points out, "Selling any prospect effectively does not follow a beaten path. Prospects and salesmen vary in temperament, habits and interests. Products sold differ, and new problems in their application and use continually crop up. But success in selling is not a haphazard affair. Proper preparation and orderly enthusiastic procedure are necessary."

The book is written in the form of short easy-to-read articles which are grouped in a series of sections entitled: Prospects are our market; just how do prospects buy; sales program essentials; make the sales program effective; successful sales interviews; sell the prospect's employees; be a better equipment salesman; getting help from others; use all our sales tools; meet the prospect's objections; follow up the customer's decision; grow in power and sales skill; and when orders hang on trees."

At a time when industrial equipment and machinery are in heavy demand with large backlogs of orders building up in many cases, it may seem that the need for sales guidance and training is not very great. Mr. Lester, however, presents sound and convincing reasons for continued, planned sales and service effort regardless of the present-day market prospects.

This book seems well suited for adoption by industrial concerns as a training manual for their sales engineers.

*Selling to Industry, by B. Lester. Cloth bound, 4½ x 7 inches, 255 pages. Published by The Industrial Press, 148 Lafayette St., New York 13, N. Y. Price, $3.50.*

• • •

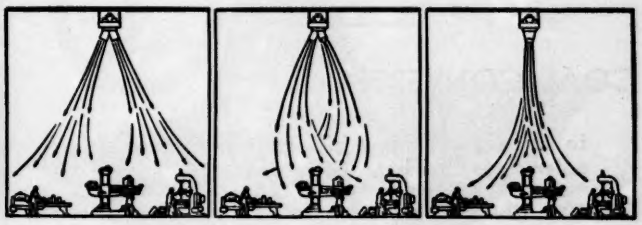
WARM AIR PERIMETER—Booklet No. 4 has been issued to present information on the design and installation of a warm air perimeter heating system in a single story basementless structure. This type of heating has proven satisfactory both for residential and commercial buildings without basements and for a structure built over a crawl space or one constructed upon a concrete slab on the ground. The 28-page booklet covers site selection and preparation, performance characteristics, classification of systems, perimeter warm air outlets and returns, concrete slab construction, installation details for slab floor buildings, crawl space construction, design procedure for crawl space systems, and common installation practices. Included are special design sheets for small houses and for larger size houses as well as sheets for the perimeter loop system and crawl space duct system. National Warm Air Heating and Air Conditioning Association, 145 Public Square, Cleveland 14, Ohio. Price, $1.

METHODS OF MEASURING HUMIDITY—NBS Circular 512 has been published on Methods of Measuring Humidity and Testing Hygrometers. A booklet of 18 pages, it covers the question of measuring water vapor content of air and other gases, controlling atmospheres of known humidity for hygrometer testing and calibration, various types of hygrometry for measurement, thermal conductivity, pressure and volume measurements, and dielectric constant. It also describes equipment for establishing desired humidities over a wide range of temperatures. Government Printing Office, Washington 25, D. C. Price, 15 cents.

MANUAL OF STATISTICAL INFORMATION—The sixth edition of the Manual of Statistical Information has been prepared by Anthracite Institute. This booklet presents data on commercial production of various types of coal, shipments of anthracite, exports and imports of anthracite, and similar types of data. Anthracite Institute, Wilkes-Barre, Pa.

# He said it was the first time in 15 years his feet had been warm!

IT happened in a large manufacturing plant in Pittsburgh where, originally, several conventional type unit heaters had been installed to heat a machine shop 300' long by 70' wide by 15' high. After many uncomfortable winters and many complaints additional units were installed. But complaints by workers continued, and finally led to an investigation of Wing Revolving Unit Heaters. First, the Wing engineer showed conclusively by smoke bomb demonstration that the warm air from the heaters in the plant did not reach the working level. Convinced of the soundness of the revolving discharge principle, the old heaters were removed and Wing Revolving Unit Heaters installed. A smoke bomb test showed how the warm air not only reached the floor, but gave complete coverage, circulating in, around and under heavy machinery and work in progress. The effect was remarkable. In fact, one old mechanic said it was the first time in 15 years his feet and legs had been warm!



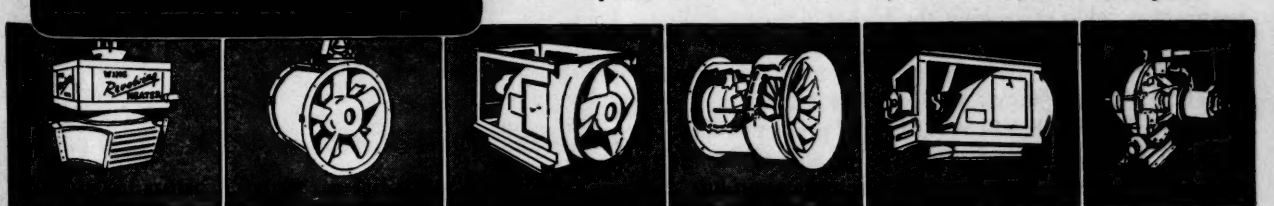
**Wing**

REVOLVING UNIT HEATERS

*Illustrated above are (left) a plant similar in type to the one mentioned in the story, showing Wing Revolving Heaters with discharge outlets for high ceilings. Other discharge outlets are available for medium heights and low buildings and rooms. The diagram (above right) shows how the constantly turning discharge outlets thoroughly and uniformly distribute the heated air, without hot blasts or cold drafts. Workmen feel only a sensation of fresh, live, invigorating warmth. Write for a copy of Bulletin HR-6.*

**L. J. Wing Mfg. Co.** 158 Vreeland Mills Road, Linden, N. J.

*Factories: Linden, N. J. and Montreal, Canada*
*In Europe: Etablissements WANSON, Haren-Nord, Brussels, Belgium*



# NEWS OF THE MONTH

## OIL SHALE YIELD

**would match present reserves in wells, according to Bureau of Mines.**

Successful completion of an analytical study of Colorado oil shale was disclosed when the Bureau of Mines published the results of tests of samples on two series of oil shale from the Mahogany Ledge of the Green River formation near Rifle, Colo.

• **HOW MUCH.**—The importance of this research is readily understood in view of the increased demand for fuels for jet and diesel engines. It is estimated that the Mahogany Ledge oil-shale bed alone covers an area of 1,000 square miles and represents an oil reserve of 100 billion barrels, or about three times the petroleum that is recoverable from wells in the Nation's proved oil fields by present methods.

The entire Green River formation covers an area of about 16,500 square miles in adjoining portions of Utah, Colorado and Wyoming.

A total of 16 tough, rocky oil shales, with colors ranging from gray brown to dark brown, were sampled. The dark brown assayed 75 gallons of oil per ton, and the gray brown assayed 10.5 gallons of oil per ton.

The shale used in this study was obtained from the Mahogany Ledge, the richest part of the Green River formation. With an average oil yield of about 30 gallons per ton of shale, this is considered the most suitable section for commercial exploitation.

## COAL CONVERTER

**to be built in South Africa for manufacture of high octane gasoline from native coal.**

Power and process steam for the first commercial plant for making high-octane gasoline from coal will be supplied by four large boilers, contract for which has been placed with Combustion Engineering—Superheater, Inc., New York. The plant is being built for the South African Coal, Oil and Gas Corp., Ltd. and will be located near Johannesburg, South Africa. A pilot plant for producing gasoline from coal has been built in this country by the U. S. Bureau of Mines, but no commercial plants have been projected here as yet. While some commercial plants were built in Germany and operated during the War, these utilized an earlier process and were not capable of making the higher octane gasoline that will be produced by the South African plant.

• **PARTICIPATING.**—The project is an international undertaking to an unusual degree. The M. W. Kellogg Company, New York, will act as overall project managers and will be responsible for the design and engineering of process facilities which will include their newly developed Synthol process of synthesis. Part of the engineering and manufacturing of the process facilities will be done by German firms, and the engineering of the power facilities has been assigned to a Belgian firm. Combustion Engineering as the prime contractor for the boilers will sub-contract some of the manufacturing to affiliated companies in France and South Africa. This distribution of the work will not only expedite construction but will help to meet problems of dollar exchange and material shortages.

• **CAPACITY.**—Each of these boilers will be capable of producing 370,000 lb. of steam per hour at 700 psi., 800 F., and will burn South African coal in pulverized form. This coal, as received, runs about 30% ash and 25% volatile, and has a heating value of around 13,000 Btu. per lb.

## ATOMIC ENERGY

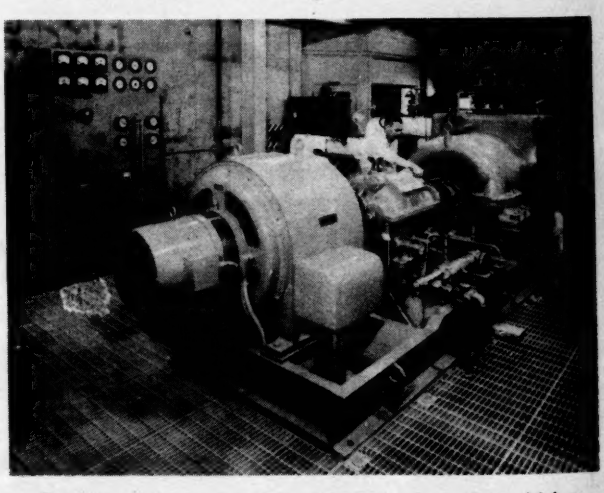
**extracted from breeder reactor as experiment in generating power proves successful.**

Small amounts of electric power have been produced from heat energy released in the operation of the experimental breeder reactor, recently completed at the National Reactor Testing Station in Idaho, it was announced by A. Tammaro, manager of the Chicago Operations Office of the Atomic Energy Commission.

• **TRIAL.**—In a trial run on December 21 and 22, 1951, electrical power of more than 100 kilowatts was generated and used to operate the pumps and other reactor equipment and to provide light and electrical facilities for the building that houses it. Test operations will be resumed after further adjustments of the reactor system.

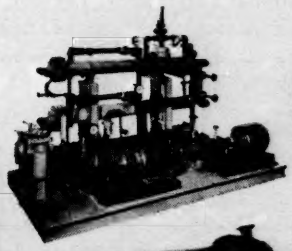
The heat energy generated was removed from the reactor by a liquid metal at a temperature high enough to generate steam to drive the turbine.

This new reactor was designed and is being operated



Turbine and generator, operating on heat from Idaho breeder reactor, supplied 100 kw of electricity for lighting and machine operation in reactor building.

# Paracoil SINCE 1915
## FUEL OIL HEATERS



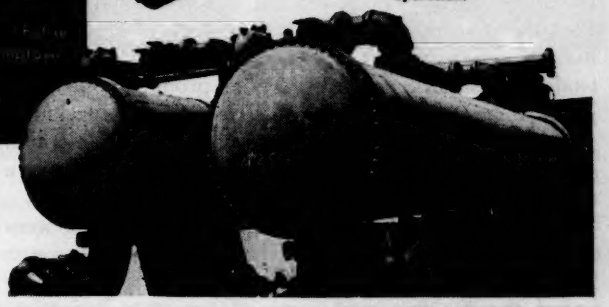
Paracoil Fuel Oil Heaters on Pump Set Assemblies. Our Tubular and Straight Tube Types are used by all leading pump set fabricators.

Paracoil Tank Suction Fuel Oil Heater. For Preheating Oil in Storage.

Paracoil Tubular Type Fuel Oil Heater. For High Pressure Steam Service. (Also made in Self-Cleaning Models.)

Paracoil "U" Tube Type Fuel Oil Heater. For Below Water Line Service.

Paracoil Line Type Fuel Oil Heater. For Bulk Station Operation.



Paracoil Vertical Type Tank Suction Heater. (For Buried Tank Installations.)

. . . have been the considered choice of the nation's leading oil burner installation contractors, burner manufacturers and package boiler fabricators . . . because:

- PARACOIL has been part and parcel of the oil burner industry from its inception—and is intimately acquainted with its needs!
- PARACOIL builds every size and type of fuel oil heater used in the industry—with capacities to 3000 GPM or more for bulk storage operation. You can standardize on Paracoil without limitation!
- PARACOIL heaters are correctly built and conservatively rated. Maximum heat transfer—low pressure losses—long operating life at top output—and freedom from service shutdowns—are annual dividends with Paracoil Fuel Oil Heaters!
- PARACOIL prices are right. Mass production of standardized models is the answer! Heavy factory stocks permit quick delivery on catalogued models and sizes.

Your Heavy Oil Installations Deserve the Best Equipment . . . Follow Paracoil Fuel Oil Heater Engineering Recommendations and Specifications!

Write for Descriptive Bulletins and Prices on your Letterhead

AGENCIES IN PRINCIPAL CITIES

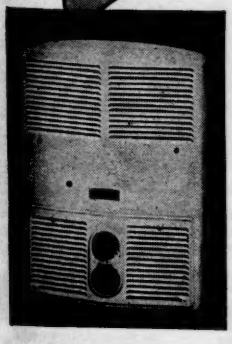
# DAVIS ENGINEERING
CORPORATION

1058 EAST GRAND STREET ELIZABETH 4, NEW JERSEY

---

Wherever it's HOT specify Sicon

NEW IMPROVED SILICONE-BASE HEAT-RESISTANT FINISH



**Protects Stewart Warner's New Saf-Aire Wall Furnace**

Quality finish specifications for this heating unit called for a coating that would stand 500° and still retain its color and gloss—a temperature far above that incurred in normal operation. Ordinary heat resistant coatings failed. SICON *Ivory* and SICON *Beige* worked perfectly...just as SICON has solved so many other finish problems. *Write for dynamic proof of SICON'S amazing stability under heat! New Brochure now ready.*

Manufactured exclusively by

**MIDLAND Industrial Finishes**

Waukegan, Ill.

ENAMELS · SYNTHETICS · LACQUERS · VARNISHES

---

MERCOID

CONTROLS PERFORM IMPORTANT RESPONSIBILITIES, AND SHOULD BE SELECTED WITH DISCRIMINATION

## IT STANDS ALONE

THERE IS NOTHING LIKE IT IN THERMOSTAT DESIGN, CONSTRUCTION AND PERFORMANCE * MOST HEATING ENGINEERS ARE FAMILIAR WITH ITS BASIC INHERENT SENSITIVITY, AND ITS NATURAL QUICK RESPONSE TO ROOM TEMPERATURE CHANGES, THEREBY ASSURING IDEAL HOME COMFORT THROUGHOUT COLD WEATHER CONDITIONS OF THE YEAR

THE REASON FOR THE MERCURY SWITCH IS THE ADDED SAFETY-BETTER PERFORMANCE AND LONGER CONTROL LIFE-ALL OF WHICH ARE IMPORTANT WHEREVER CONTROLS ARE REQUIRED

IT WILL PAY YOU TO SPECIFY MERCOID CONTROLS FOR YOUR AUTOMATIC HEATING EQUIPMENT

THE MERCOID CORPORATION * 4201 BELMONT AV., CHICAGO 41, ILL.

by the Argonne National Laboratory, Lemont, Illinois—the reactor research center run for the AEC by the University of Chicago. The tests were supervised by Laboratory Director Walter H. Zinn and Mr. H. V. Lichtenberger, the project engineer for the experimental breeder reactor.

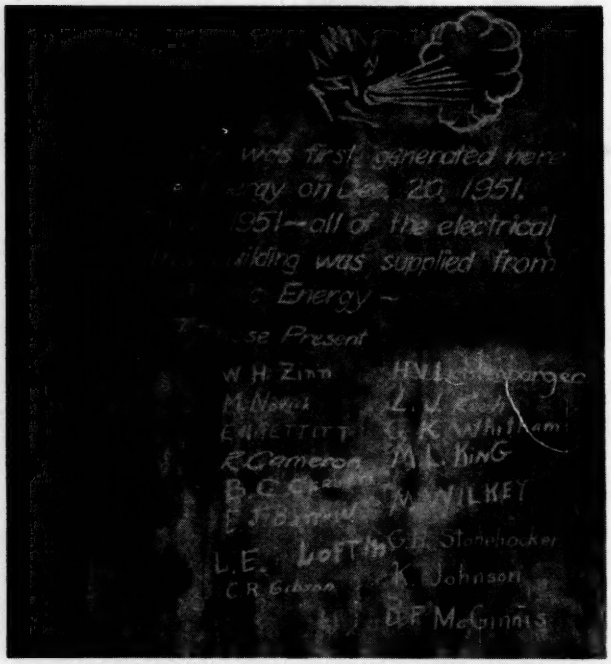
• **PURPOSE.**—The principal function of the breeder reactor is the long range goal of converting nonfissionable material into fissionable material more rapidly than nuclear fuel is consumed, a process that would contribute to expansion of the current atomic weapons program.

The power generation phase is incidental but is being carried out to secure experimental information on the handling of liquid metals at high temperatures under radioactive conditions and on the extraction of heat from a reactor in a useful manner. The system at the breeder reactor can never generate large amounts of electrical power but it does provide a useful tool for carrying out such experimental studies.

• **COST.**—Dr. Zinn emphasized that no comparisons should be made of the cost of producing electric power from this reactor with power from conventional sources. Cost was not an essential factor in the power phase of the Idaho reactor and the experiment is in no way intended to establish the feasibility of producing electrical power economically from nuclear sources. The technical information gained, however, may be useful in the design of future reactors aimed at generating electricity at a competitive cost.

The reactor itself and its principal components were erected at the Idaho testing station by the Argonne National Laboratory. The Austin Co., Cleveland, designed the building and some of the reactor system. Construction at the site was by the Bechtel Corp., San Francisco, under the supervision of the AEC's Idaho Operations Office headed by L. E. Johnston.

Total construction cost was about $2,700,000. Approxi-




Sixteen scientists, engineers, and assistants who participated in first known production of useful electric power from atomic energy inscribed their names on the wall of the power plant room.

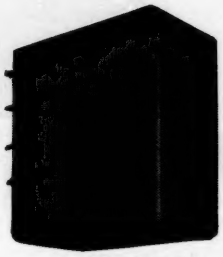

*A unit heater for every need*

from

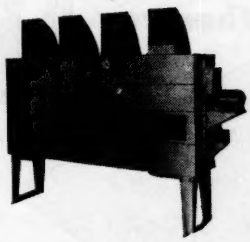
**HERMAN NELSON**

**Vertical shaft propeller-fan type unit heater**—*especially suited to buildings with high ceilings—up to 50 feet.*

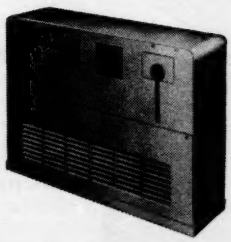
**Horizontal shaft propeller-fan type unit heater**—*the most generally useful of all space heaters.*



**Centrifugal-fan type unit heater**—*for efficient heating and ventilating of large industrial spaces.*



**De Luxe unit heater**—*an attractive, quiet operating unit designed for stores, offices, churches, etc.*



Write for detailed information about any type Herman Nelson Unit Heater to: Dept. HV-3.

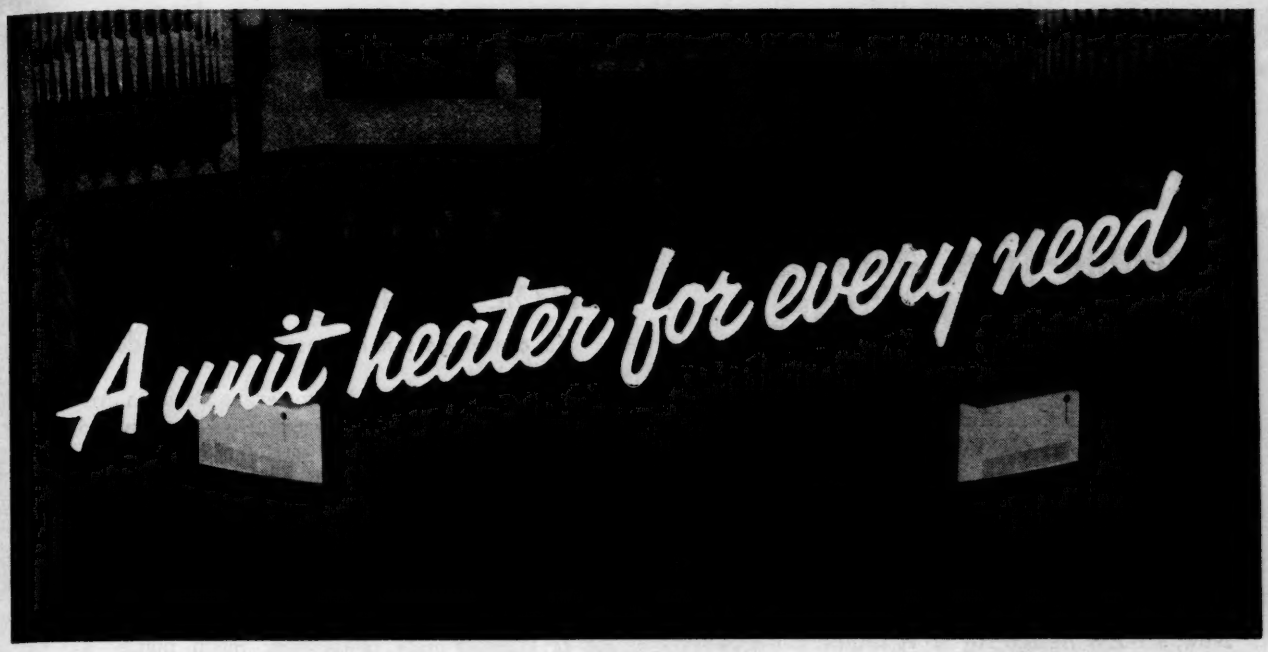
AAF

herman nelson moline illinois

**HERMAN NELSON**

*Division of* **AMERICAN AIR FILTER COMPANY, INC.**

**MOLINE, ILLINOIS**




## . . . FROM HERMAN NELSON

IN the church shown above, 30 Herman Nelson De Luxe Unit Heaters maintain comfortable temperatures for all services. These versatile units are equally effective for heating stores, offices, markets, display rooms and similar buildings where compact, attractive, quiet-operating heating units are needed.

There are eight models of these unit heaters available for floor, wall, ceiling or recessed installation. All models have an improved "combination type" heating element suitable for either steam or hot water operation. The De Luxe Unit Heater cabinet contains modern styling obtained through superior designing. The absence of projecting parts and its rounded ends contribute to its graceful appearance. The unit is finished in satin-smooth, tan, baked enamel so that it enhances the setting in any application.

Herman Nelson Unit Heaters are ahead of the field because constant engineering development and research plus functional design have earned this position—the result of 45 years of experience in the production of heating and ventilation equipment.

**ALUMINUM CENTRIFUGAL FAN WHEELS** have slow tip speeds for quieter operation.

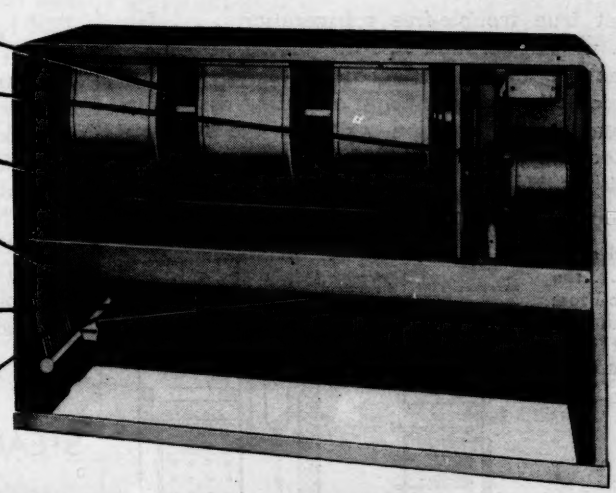
**ADJUSTABLE PULLEY** permits varying performance to meet exact requirements of job.

**CONTINUOUS, NON-FERROUS FINS** are formed with extra wide flange to provide efficient contact between expanded tubes and fins.

**LOOP** in each tube of heating element absorbs difference in expansion and contraction between individual tubes.

**PATENTED, EXTRA HEAVY, RED BRASS STAY TUBE** maintains proper relationship between headers without increasing strain on loops and allows entrained moisture to drain directly from supply to return header.

**ENTIRE TUBE AND LOOP** is fabricated of red brass with no connecting joint to weaken construction.



AAF herman nelson

# HERMAN NELSON

*Division of* **AMERICAN AIR FILTER COMPANY, INC.**

**MOLINE, ILLINOIS**

# With This NEW Improvement Niagara "No-Frost Method" puts you a big step ahead in trouble-free, automatic refrigeration or freezing

Niagara "No-Frost Method" keeps frost and ice COMPLETELY OUT of your cooling, chilling, freezing or cold storage.

It uses Niagara No-Frost Liquid Spray to keep frost and ice from ever forming. It gives you, automatically, refrigeration with no defrosting, and full capacity NEVER cut down by ice building up progressively on refrigeration coils.

Now, a NEW design No-Frost Liquid concentrator, using a new principle, takes away moisture as fast as it is condensed by evaporating it at low temperature —not boiling it away at high temperature. It has 14 times the capacity of the old method per dollar of investment — one concentrator will handle a battery of high capacity spray coolers.

This gives you more refrigeration at lower cost; less machinery in less space. You operate at high suction pressure, saving power and wear and tear on compressors.

The extra capacity and lower cost both for equipment and operating makes this method advantageous for every type of refrigeration use—both for freezing and for moderate temperatures—for large "live" loads as in meat chilling or in fruit and vegetable precooling — for rooms that are filled and emptied of product daily, such as milk rooms and terminal storage warehouses.

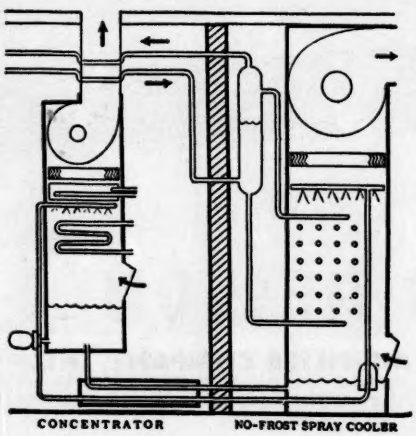
You get true trouble-free refrigeration . . . No brine . . . no salt solution . . . no dirt . . . no mess . . . It is entirely clean; you get rid of dirt and odors. You reduce both equipment and operating costs.

For complete information write to the Niagara Blower Company, Dept. HV, 405 Lexington Avenue, New York 17, New York.

If you need extra capacity . . . the Niagara "No-Frost Method" can help you get it with your present compressor.

•

A simple method, easily maintained. Saves a third of your refrigeration cost . . . Ask for Niagara Bulletins 118 and 119.



CONCENTRATOR NO-FROST SPRAY COOLER


mately $2,500,000 was spent by the Laboratory over a 4-year period for research and engineering development.

Marion W. Boyer, AEC general manager, has sent congratulations on behalf of the commission to Dr. Zinn and his associates. He said that the successful operation of the experimental breeder is evidence of the thorough and capable work which has gone into this program.

## AIRFOIL BLADING

**for centrifugal fans increases efficiency, reduces noise.**

Tests in Westinghouse's Sturtevant Division Air Handling Research Laboratory were recently completed on a scale model of a new centrifugal fan wheel with airfoil blading. The tests strikingly demonstrated the mechanical efficiency of airfoil blading—92% compared to 84% for conventional bladed fans. In addition, this new fan is considerably quieter—developing 65% less noise energy than conventional fans.

• **CHARACTERISTICS.**—Ordinarily the blades of centrifugal fans are simple rectangular metal plates—flat or curved—welded in the rotating element. In the case of the airfoil fan, the blade cross-section is similar to that of an airplane wing cross-section—teardrop shaped and curved backwards from its direction of rotation. Such a blade exerts positive pressure on the air over its entire face from the leading edge to the trailing edge. As a result, air flow is smooth with a minimum of turbulence.

Airfoil blades are more costly as each is a hollow steel shell with supporting struts welded longitudinally inside. The higher efficiency of this fan makes the construction worthwhile as the savings in horsepower during the write-off life more than repays the small premium in first cost.

• **INSTALLATION.**—Eight fans with airfoil fan wheels will be used in the new Astoria Station of the Consolidated Edison Company, New York City. Two sets of fans will be used for each of two boilers. Each set will consist of two fans in series, each fan driven by a Westinghouse 1250 hp motor. Vane control is provided for efficient part load operation; one or both fans of the two in series can be operated as desired. The overall efficiency of the two fans in series is 86%. This makes possible still higher efficiency at partial loads.

An interesting footnote to the Astoria Station application is that these fans will be the sole source of mechanical draft. New type, pressurized boilers—a boiler encased in an airtight jacket—eliminate the need for induced draft fans. This means a savings in the cost of induced draft fans, plus savings in space requirements, operating cost, and maintenance.

## STEAM GENERATOR INDUSTRY

**urges OPS to place erection services under construction pricing regulation rather than machinery order.**

Members of the Steam Power Generating Equipment Industry Advisory Committee met for the first time in January with officials of the Office of Price Stabilization

*Darling it's so exciting . . .*

*I just can't wait*

*to see those sensational, new*

**STANDFORATED**

# Perimeter Baseboard Registers

**WITH SLIDING DAMPER CONTROL**

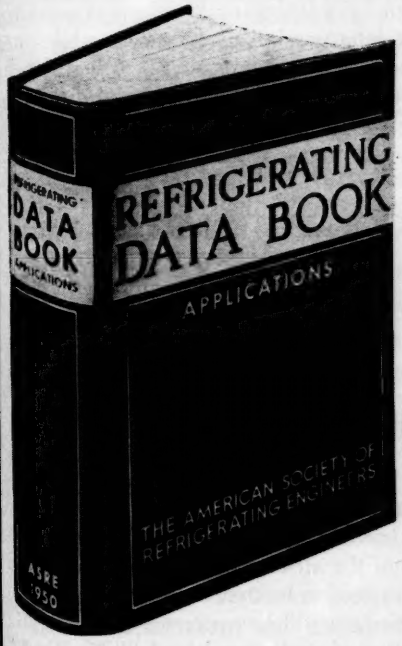
**Write Now for Your Free Copy of Standard's Amazing New Pocket Catalog**

- Used in homes, schools, churches and commercial installations.
- Comes in four foot sections.
- Simplifies balancing of heating systems.
- Fabricated of 20 gauge steel.
- Finished with Prime Coat only—special finishes on request.

## Standard Stamping & Perforating Co.

**3129 WEST 49th PLACE, CHICAGO 32, ILLINOIS**

*Attach this to your business letterhead and mail for new catalog.*




**A COMPLETE REFERENCE BOOK FOR YOUR LIBRARY**

***containing***

**More than 1,000 pages of practical information on the application of refrigeration in many and varied uses**

**Eighty-one chapters devoted to a specific application and closely allied subjects**

**Hundreds of photographs, drawings, and tables.**

**For time-saving data at your fingertips, for comprehensive, authoritative information, you can do no better than order a copy of the APPLICATIONS VOLUME of the ASRE Data Book.**

**FILL OUT AND MAIL THIS COUPON →**

**$7.50 payable with order.**

**Date** .....

**American Society of Refrigerating Engineers**
**40 West 40 Street, New York 18, N. Y.**

**Please send me a copy of the 1950 APPLICATIONS VOLUME of the ASRE Data Book, which costs $7.50 in the U. S., $8.10 elsewhere.**

☐ **check enclosed** ☐ **send COD**

**Name** .....

**Home address*** .....

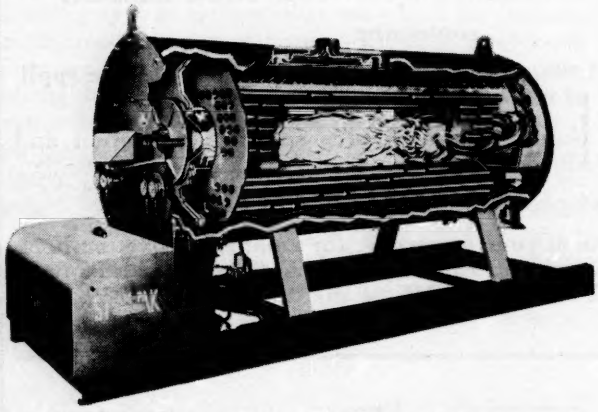
**Firm** .....

**Firm's street address** .....

**City** .....**Zone No.**.....**State**.....

***If book is to be sent here** **H&V-3/52**

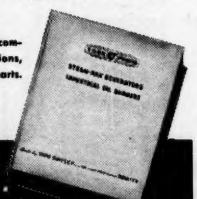
**YES**—and well he should be—because he has found out that Steam-Pak Generators really operate automatically, are fast heating, and save many dollars in fuel cost. But to him, one of the biggest factors is their cleanliness. These are just a few of the features. Write us for more details.



Steam-Pak Generators are built in a full range of sizes from 15 to 250 hp. for high or low pressure steam or hot water and can be fired with No. 3, 5, or 6 fuel oil or gas or a combination of both.

GET YOUR COPY OF THIS MANUAL TODAY

Steam-Pak's 208-page Architects' Manual is the only complete reference on steam generators. Contains specifications, hook-ups, wiring and piping diagrams, operating charts. Request Manual 101-C today on your letterhead.



YORK-SHIPLEY, INC.
Industrial Division, York 7, Pa.
Automatic Heat & Power Specialists since 1918

to discuss industry pricing problems under the machinery ceiling price regulation (CPR 30).

• **SITUATION.**—The industry is concerned with the manufacture, fabrication, installation and erection of large individually engineered and designed steam power generating equipment and related equipment such as coal pulverizers, economizers, air heaters, etc. The equipment involves installations that range from relatively small portable steam generating boilers to huge generating plants up to 14 stories in height. It is estimated that the industry's annual volume of sales will exceed $250 million.

The industry generally is required to price under the formula pricing provisions of CPR 30 both as to equipment manufactured and the installation and erection services furnished in connection with its sale. The pricing formula, in general, provides for use by the manufacturer of his pricing method in effect during his base period, as applied to labor and material costs in effect on March 15, 1951. (In some cases materials costs as of December 31, 1950, are used.)

• **SQUEEZE.**—Committeemen said the industry has been squeezed somewhat by increases in labor and material costs since March 15, 1951, as applied to manufactured equipment. In this connection, they added, it has become increasingly necessary to purchase steel from steel warehouses rather than direct from the mill and in many cases it is necessary to subcontract with the steel warehouse for fabrication of steel in order to obtain the steel.

With respect to pricing of installation and erection services, they said, the industry is experiencing serious difficulty because of increased and varying labor and materials costs since March 15, 1951, and because the industry is in an inequitable competitive position with other contractors who price under the construction ceiling price regulation CPR 93, using a restricted markup applied to current labor and material costs, while the industry is required to price under CPR 30, using March 15, 1951 labor and materials costs for performing the same type of installation and erection services.

## NATIONAL CONVENTIONS

**spur air conditioning of Chicago hall to cool political party sessions.**

Chicago will soon have its first big, permanently air-conditioned convention hall—thanks to the Republican and Democratic parties.

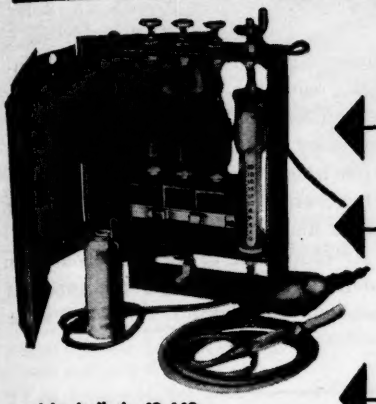
Officials of the huge International Amphitheater, when notified that their building had been selected by both parties as the site for the 1952 national conventions in July, began an immediate conversion of the arena into the latest type of air-conditioned structure.

• **SYSTEM.**—Heart of the air-conditioning system will be the four large fan systems now used to heat the 12,000-person building. The fans will be converted to air-conditioning by the addition of cooling coils and filters. Working in conjunction with auxiliary air-conditioning units, the fans will be capable of circulating 290,000 cfm, enough to completely change the air within the shell-like arena five times per hour. Additional air outlets will be added to the present air distribution duct system, it was explained.

The centrifugal refrigeration machinery consists of

# Analyze for $CO, CO_2, O_2$ with one instrument

## HAYS ORSAT GAS ANALYZER



**Complete**—3 absorption units provide complete gas analysis for all the operating engineer's needs.

**Rugged**—built for continuous field use . . . strong, pressed steel construction.

**Portable**—contains everything you need to make a complete analysis . . . in one easy-to-carry case. Compact, yet all parts are easily accessible.

*send for bulletin 49-668 for complete description of all styles.*

The Hays Orsat Type Gas Analyzer is simple, fast, and employs the most reliable method known for obtaining accurate measurement. Available in one, two or three-unit styles (illustrated).

## THE HAYS CORPORATION

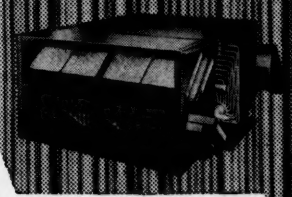
*MICHIGAN CITY 28, INDIANA*

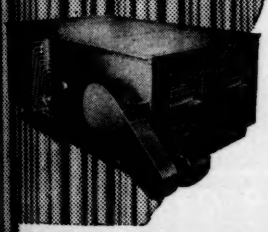
combustion and industrial instruments and control

# MASSACHUSETTS

PRESENTS

**THE NEW MASSACHUSETTS AIR CONDITIONING UNITS**





**SEVEN SIZES . . . . . available, ranging from 1,000 to 14,000 C.F.M. Designed to combine cooling in summer, heating in winter.**

**Built in sections - Vertical or horizontal mounting. Various combinations and arrangements of discharge and by-pass damper.**

*Write for catalogs.*

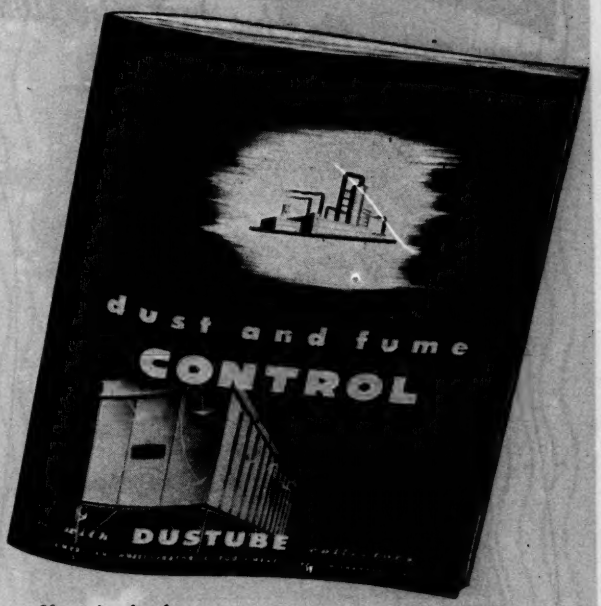
MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

4901 HAMILTON AVENUE CLEVELAND 14, OHIO

NEW

*for the engineer working with DUST and FUME PROBLEMS*




If you're in the habit of working with dust and fume problems, you will find the new Dustube Catalog a source of helpful information. It contains practical charts and useful tables designed to help you save time and effort in engineering dust and fume control systems. It explains how Dustube Collectors combine the proved efficiency of cloth filtration with a unique operating simplicity and economy. It describes the various types of Dustube Collectors and provides detailed information on each.

To be sure you get your copy, fill in the coupon below and mail it today.

mail this coupon today

American Wheelabrator & Equipment Corp.
619 S. Byrkit St., Mishawaka 4, Indiana
Please send me your new dust and fume control catalog, 72-B.

Name.....

Company.....Title.....

Address.....

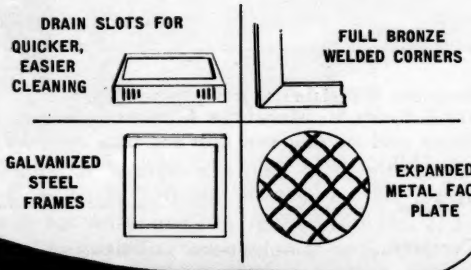
City.....State.....

American WHEELABRATOR & EQUIPMENT CORP. 619 S. Byrkit St., Mishawaka 4, Ind.

dustube COLLECTORS

Airsan
EXTRA FEATURES
mean more effective dust collection

Airsan Air Filters offer you extra features that save you money, offer greater filtering efficiency. Initial cost and installation is less. Easier cleaning and larger dust-holding capacity cuts maintenance expense. Approved by Underwriters' Laboratories. Investigate Airsan today. Learn why it pays to *buy the difference* — at no extra cost.


DRAIN SLOTS FOR QUICKER, EASIER CLEANING
FULL BRONZE WELDED CORNERS
GALVANIZED STEEL FRAMES
EXPANDED METAL FACE PLATE

Air Filter Corporation
108 H NORTH WATER ST. • MILWAUKEE, WIS.
Canadian Representative
DOUGLAS ENGINEERING CO., LTD., MONTREAL
A Few Distributorships Available. Write for Details

Name "AIRSAN" is Reg. U. S. Pat. Off.

400- and 600-ton machines. It will circulate chilled water to the cooling coils by means of pumps and a system of piping.

Another feature of the air-conditioning system, designed by Minneapolis-Honeywell heating engineers working in collaboration with consulting engineers A. Epstein and Sons, and Carrier Corporation's refrigeration experts, is a roof spray system designed to minimize solar heat penetration.

• **DESIGN.**—The engineers' design is based on maintaining 80F and 50% R.H. inside the convention hall when outside temperatures register 95F D.B. and 75F W.B., with the capacity occupancy of 12,000 persons.

The refrigeration machinery will also be capable of producing enough refrigeration for a regulation size ice hockey rink on the arena floor.

Conversion of the Amphitheater to air-conditioning is expected to make the building a popular spot for conventions, athletic events and entertainment spectacles the year 'round.

## PLASTIC PIPE

**to be studied with reference to toxicity and chemical stability when used in water systems.**

Anticipating increased use of plastic pipe in water supply systems . . . likely to be hastened by metal shortages . . . manufacturers of extruded plastic products and their raw material suppliers have persuaded the National Sanitation Foundation, headquartered at the University of Michigan in Ann Arbor, to start on research to determine whether such pipe is nontoxic and has the chemical stability necessary for water supply adaptations.

• **WHO.**—The studies, which will also evaluate the various types and classes of plastic for the making of water pipe, are expected to extend over at least two years. Walter D. Tiedeman, head of the Foundation's testing laboratories, former chief of the milk and restaurant sanitation section of the New York State Department of Health, will be in charge. He will work closely with an advisory committee composed of sanitarians and public health officers from various parts of the country and an equal number of designated representatives of the plastics industry.

• **TESTS.**—Initial tests will be made on 26 samples of pipe manufactured of polystyrene, polyethylene, cellulosic materials, and copolymers of polyvinyl chloride. Part of the research contemplates the feeding of granulated samples to rats and restriction of their water supply to that circulated through the special pipe. Water to be used in the tests will be tested as warm as 25 degrees centigrade. Facsimile water systems built of the pipe will be set up in the laboratory. Answers will be sought to two main questions: Do any types of tap water become polluted by contact with the specific types of plastic? If there is erosion in plastic pipe, will continued ingestion of the eroded plastic cause pathological changes?

• **WHY.**—A limited quantity of plastic pipe has been manufactured for water system use in recent years and there have been some installations of it, mostly in rural sections. With its expanded use, however, it has come to the special attention of local health officers throughout

# Insist on the Genuine! RIC-WIL

## SECTIONAL TILE AND CAST IRON CONDUIT SYSTEMS

Since 1910, Ric-wiL has been furnishing Sectional Conduit Systems for low cost, efficient protection of underground insulated pipe lines.

1 **Entire system** designed by expert engineers of long experience to meet every requirement for unusual tightness, permanent alignment and long life.

2 **Pipe Supports** designed for strength to carry the piping load.

3 **Insulation** furnished as specified or as recommended by Ric-wiL's outstanding staff of engineers.

4 **Delivery:** Any size or quantity promptly from large stocks.

***CHECK THE FOLLOWING EXCLUSIVE FEATURES:***

ONLY RIC-WIL has Loc-liP joint running along entire length of conduit, including bells—assuring a completely sealed, watertight joint.

ONLY RIC-WIL design has base drain with side shoulders which carry entire weight of piping independent of conduit.

## THERE IS A RIC-WIL SECTIONAL SYSTEM FOR EVERY GROUND CONDITION:

**STANDARD TILE CONDUIT**—for normal ground loads.

**SUPER-TILE CONDUIT**—with extra heavy walls, under roadways.

**CAST IRON CONDUIT**—for installation under or near railroad tracks.

**UNIVERSAL TILE CONDUIT**—with half tile arch, trapezoidal side blocks, and concrete foundation.

Don't make the mistake of accepting inferior, poorly-designed and rank imitations of the original Ric-wiL Sectional Systems. Make sure you specify "RIC-WIL"—preproved by thousands of installations—and know that you are getting the BEST.

**Write for Latest Catalog Section 480-4A.**

# RIC-WIL

## INSULATED PIPING SYSTEMS

UNDERGROUND OR OVERHEAD

**THE RIC-WIL COMPANY • CLEVELAND, OHIO**

AGENTS IN PRINCIPAL CITIES

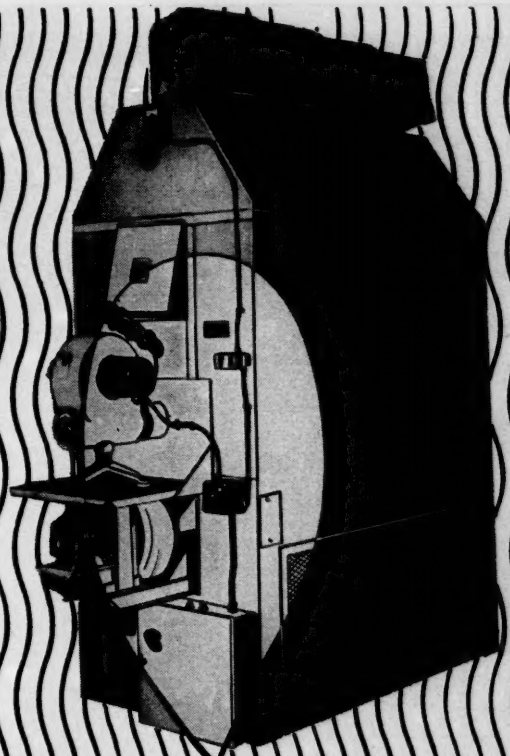
**LEADERS IN INSULATED PIPING PROTECTION**

**PREFABRICATED INSULATED PIPING**

**SECTIONAL CONDUIT SYSTEMS**

**PREFABRICATED MANHOLES**

**UTILIDOR TYPE CONDUITS**

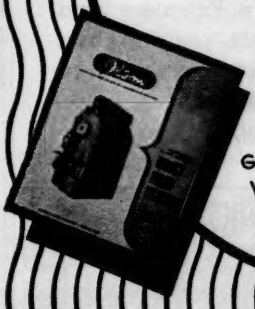


## SEPARATE DRAFT FAN

. . . Eliminates objectionable cold air blast at every start. Personnel directors say this extra feature is especially appreciated by employees.

*Olson*

**ARTHUR A. OLSON & COMPANY**
**Broad Street, Canfield, Ohio**



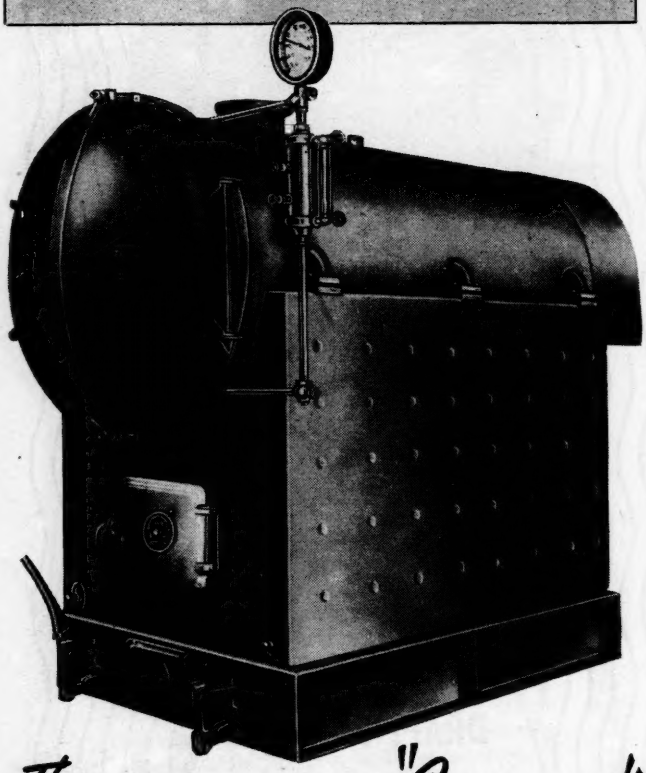
***DIRECT FIRED HEATERS***
***Gas, Oil, Coal***
***or Dual Gas and Oil***

Get the inside story
Write for catalog
No. F50HL

*Your All-Around Boiler*

**FOR ALL FUELS**

**AND ALL TYPES OF FIRING**



*The* **TITUSVILLE** *"Compact"*

**Steel Heating Boiler**

Economical use of oil, gas or coal is an outstanding advantage of the Titusville "Compact" Boiler. An exceptionally large combustion chamber runs the full length of the shell, providing ample space and time for complete burning—yet the boiler takes up less room than any other type. ● Extensive automatic welding of seams and joints, positive circulation, steel flue-door assemblies and other refinements assure trouble-free service.

*Write for Bulletin B-3000-B.*

**THE TITUSVILLE IRON WORKS COMPANY**

A division of Struthers Wells

Representatives in Principal Cities

**TITUSVILLE, PENNSYLVANIA**

the country who are raising questions about its suitability because no tests of its toxicity and chemical stability, which those officers will consider authoritative, have been made to date.

---

• Three executives of Carrier Corp. were killed suddenly Tuesday afternoon, January 22, in the crash of an American Airlines plane at Elizabeth, N. J. They were John F. Chester, 45, director of public relations, Carl U. Spriggs, 44, manager of the dealer sales division, and H. Lee Sterry, 50, executive assistant. The company announced on January 29 that Russell H. Gray of its Atlanta office has been appointed executive assistant to the executive vice president, succeeding Mr. Sterry, and that Ralph Ebbert has been appointed acting director of public relations to succeed Mr. Chester. John M. Bickel has been appointed manager of the dealer sales division to succeed Mr. Spriggs.

• Several changes and appointments have been made in the management and sales organization of Penn Controls, Inc., Goshen, Ind. R. S. Penn has been appointed vice president for operations and E. B. Maire has been named vice president and director of sales. J. M. Reid, controller, has been appointed as a member of the executive committee. M. E. Henning, formerly executive vice president, has resigned. R. H. Luscombe continues as general sales manager and R. V. Clark as manager of heating and appliance control sales. K. W. Cash, formerly assistant sales manager, has been named manager of control sales for refrigeration, air conditioning, engines, pumps and air compressors.

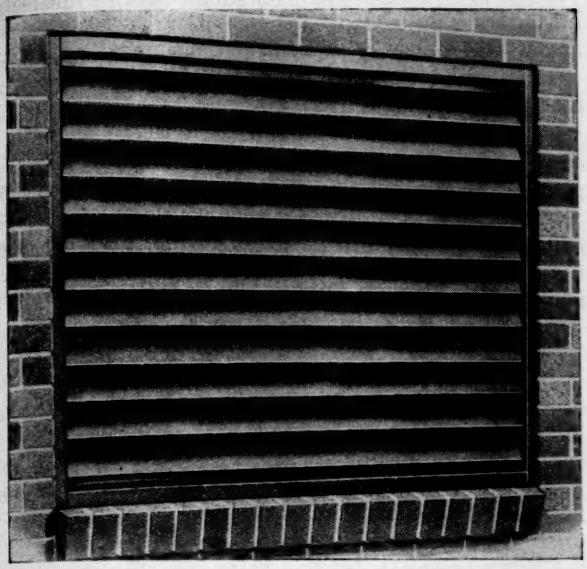
• Frank J. Nunlist, Jr., has been named general sales manager of the L. J. Mueller Furnace Co. Mr. Nunlist succeeds C. L. Hewitt, Jr., who resigned and is moving to California.

• The Old Timers Club of the Oil Burner Industry Inc., will hold its annual jamboree Tuesday evening April 15, at the Lu Lu Temple, 313 South Broad St., Philadelphia, Pa. A booth will be available Sunday, Monday and Tuesday at the entrance to the Oil Heat Show to accept new applications, payment of dues and jamboree reservations. Prior reservations should be made with the secretary, H. A. Maccubbin, 120 West Madison St., Villa Park, Ill.

---

## GETTING PERSONAL

**Herbert Herkimer** (*Apparatus Dew Points at Elevations Above Sea Level*, page 77) is an M.E. graduate of Cornell University and a licensed Professional Engineer whose experience in air conditioning dates back to the pioneering period of Vento Heating Coils and Safety Carbonic Refrigeration. From 1930 until the beginning of World War II he directed the Herkimer Institute of Mechanical Trades, New York City, which specialized in the training



# Now you can equip any wall opening with Swartwout Airlouvers

The conveniently wide size variation available in Airlouvers virtually gives you custom-made equipment at economical standard costs. It's easy to fill any size wall opening with one or more Airlouver units—in either adjustable or fixed types.

These louvers have excellent appearance and high utility. The percentage of free opening area is as large as possible consistent with complete weather-proofness. Strong formed channel frame construction houses overlapping blades. Several methods of operating are optional. Various types of mounting facilities enable you to make the most suitable installation according to building construction. Write for Bulletin 339 H.

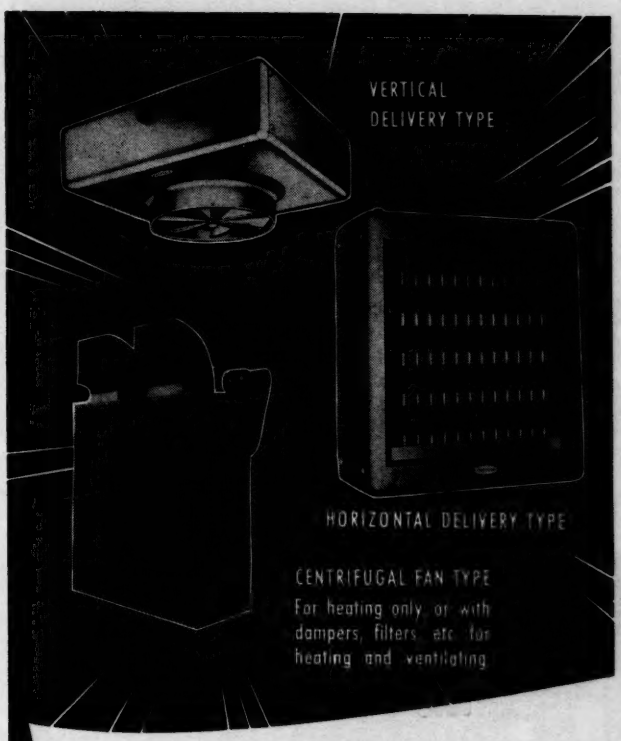
*Swartwout makes a complete line of gravity and powered roof ventilators to fill every need on any type of industrial, commercial or public building.*

18511 Euclid Avenue, Cleveland 12, Ohio

**The Swartwout Co.**

**Roof Ventilators and Ventilating Louvers**

POWER PLANT EQUIPMENT • PROCESS INDUSTRY CONTROLS


VERTICAL
DELIVERY TYPE
HORIZONTAL DELIVERY TYPE
CENTRIFUGAL FAN TYPE
For heating only or with dampers, filters, etc. for heating and ventilating

## Insure Customer Satisfaction...

## Install AIRTHERM Steam Unit Heaters

*Save Fuel... Provide Trouble-Free Service*

**There's an Airtherm Steam Unit Heater designed to meet every space heating need.**

**Airtherm offers you Horizontal and Vertical propeller fan types for all commercial and industrial installations plus the Centrifugal fan type for handling large air volume, long heat throw and ductwork resistance.**

**The long life coils in Airtherm Unit Heaters have copper tubes and copper headers, brazed into an integral heat transfer unit.**

**Your customers know Airtherm Unit Heaters. They are nationally advertised. Write for Catalog 1208B for additional information.**

***For Heating Satisfaction . . . Think First of AIRTHERM***

SEE OUR CATALOG IN SWEET'S

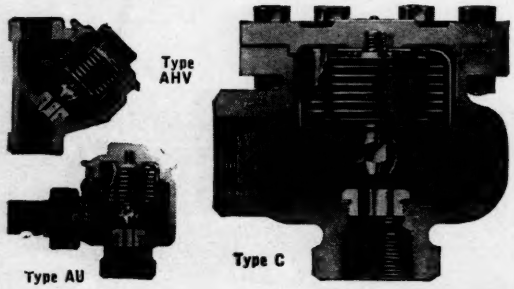
**AIRTHERM MANUFACTURING COMPANY**

**722 South Spring Avenue • St. Louis 10, Missouri**

Nicholson Traps Help

CUT STEAM COST $500,000 A YEAR

At one of the nation's large processing plants a campaign to promote economical steam use by improving heat transfer efficiency has resulted in a yearly saving of $500,000. Credit for a fair portion of this is given to improved steam trapping, which resulted from the installation of Nicholson thermostatic traps. To see why an increasing number of leading plants are standardizing on Nicholsons for positive drainage and faster heat transfer, send for BULLETIN 152.




W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

199 OREGON ST., WILKES-BARRE, PA.

MEET THE NEW MODEL

MUCKLE VENTS

Take a look at the new silhouette . . . its low slung and streamlined—better looking on any roof!




Get away from old, "eye sore" ventilators—get the newly designed Muckle Vents. Engineered for better performance in moisture-laden air—the motor is out of line of air flow. A compact, good looking, easy to install all-in-one unit to fit any roof.

Some territories open for sales representatives

Write today for more information on Muckle Vents.

Muckle MANUFACTURING CO.

OWATONNA 3, MINN.

of service men for the refrigeration, air conditioning and oil burner industries. At the same time he operated an engineering supply business in partnership with his son.

During World War II he served with the U. S. Maritime Commission. In 1947 his book, Air Conditioning, was published, with his son, Harold Herkimer, as co-author. His latest work, The Engineer's Illustrated Thesaurus, released in January, 1952, contains over 8,000 illustrations of machine elements and assembled machinery. His hobby is collecting and compiling engineering information, and he is currently preparing another book for publication.

J. M. Ruddy

**John M. Ruddy** (*Air Conditioning Rodent Quarters*, page 95) is chief engineer of the Planning and Plant Maintenance Department of Brookhaven National Laboratory where he organized an engineering group and has been responsible for the design and construction of the facilities and the installation of special research machines and equipment since the early days of this basic atomic research laboratory in 1947. He is a graduate of Manhattan College, Bronx, New York, and was plant layout supervisor for the Engineering and Research Division of Sperry Gyroscope Co. prior to his present position. Mr. Ruddy is a Member of the A.S.C.E. and a registered professional engineer in the State of New York. He is also an author of several papers in the field of atomic energy and research laboratory facilities planning, and is a consulting engineer.

**Canadian Degree-Days for December, 1951 and January, 1952***

| City | December | | January | |
|---|---|---|---|---|
| | 1951 | Normal | 1952 | Normal |
| Calgary, Alta. | 1700 | 1426 | 1861 | 1609 |
| Charlottetown, P. E. I. | 1271 | 1246 | 1373 | 1463 |
| Crescent Valley, B. C. | 1414 | 1240 | 1321 | 1352 |
| Edmonton, Alta. | 1865 | 1578 | 2077 | 1814 |
| Fort William, Ont. | 1736 | 1596 | 1844 | 1807 |
| Grande Prairie, Alta. | 1928 | 1649 | 2207 | 1841 |
| Halifax, N. S. | 1076 | 1138 | 1155 | 1283 |
| London, Ont. | 1218 | 1200 | 1221 | 1336 |
| Medicine Hat, Alta. | 1699 | 1417 | 1860 | 1643 |
| Moncton, N. B. | 1370 | 1373 | 1425 | 1528 |
| Montreal, P. Q. | 1380 | 1407 | 1507 | 1552 |
| North Bay, Ont. | 1566 | 1528 | 1649 | 1658 |
| Ottawa, Ont. | 1420 | 1494 | 1578 | 1646 |
| Penticton, B. C. | 1271 | 1073 | 1314 | 1184 |
| Porquis Junction, Ont. | 1810 | 1786 | 1947 | 2052 |
| Prince George, B. C. | 1752 | 1504 | 1774 | 1615 |
| Quebec City, P. Q. | 1451 | 1534 | 1603 | 1696 |
| Regina, Sask. | 2013 | 1779 | 2140 | 2037 |
| St. John, N. B. | 1215 | 1271 | 1314 | 1417 |
| Saskatoon, Sask. | 2114 | 1767 | 2223 | 2027 |
| Toronto, Ont. | 1117 | 1155 | 1165 | 1304 |
| Vancouver, B. C. | 951 | 818 | 933 | 893 |
| Victoria, B. C. | 847 | 738 | 849 | 815 |
| Windsor, Ont. | 1153 | 1172 | 1135 | 1283 |
| Winnipeg, Man. | 1894 | 1829 | 2080 | 2111 |

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

# AIR-FLO

**AUTOMATIC**

## CEILING SHUTTER

**FOR ATTIC FAN**

Built so they can be installed practically flush with the ceiling, AIR-FLO Ceiling Shutters present a refined, finished appearance. Their natural aluminum color blends with any decoration, eliminating need for painting, and no grille or winter cover is required. Furnished in 5 different widths, single panel up to 73" long. No operating mechanism shows. Built-in fusible link. Meets fire underwriters' requirements.

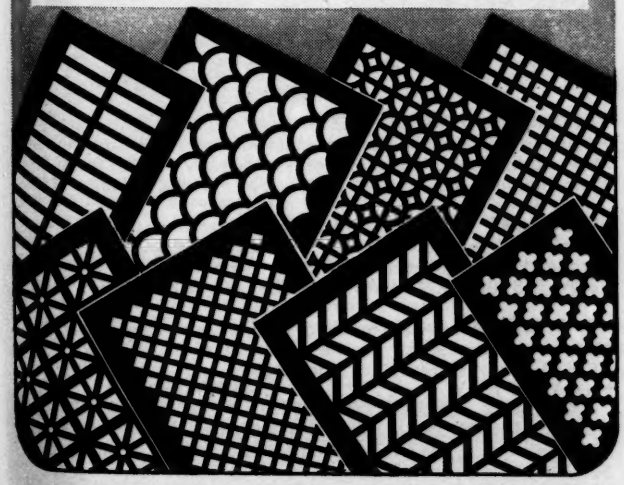
**WRITE FOR NEW CATALOG 44-F**
**Illustrations and details of the complete AIR-FLO line**

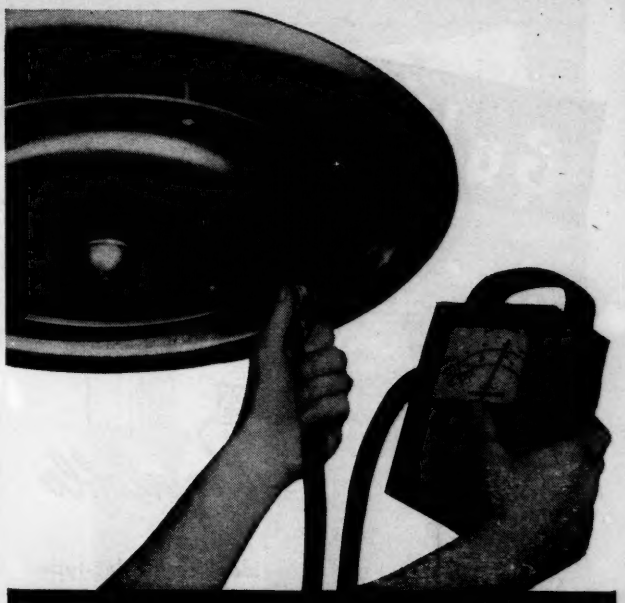
**AIR CONDITIONING PRODUCTS CO.**
2340 W. LAFAYETTE BLVD. · DETROIT 16, MICH.

# AUER GRILLES

Heating, air conditioning and plumbing contractors and engineers receive expert service from Auer on perforated metal grilles. The Auer line includes a variety of attractive designs for all purposes—air conditioning, ventilating, radiator enclosure, or concealment. We furnish almost any size, to your order, and in all available materials. Order Auer grilles by name and number. Send for bulletin showing all designs.

**THE AUER REGISTER COMPANY**
6600 Clement Ave. Cleveland 5, Ohio





# Kno-Draft recommends Alnor VELOMETER for Precision Air Flow Readings

**Ask The W. B. Connor Engineering Corporation how to balance an installation equipped with their Kno-Draft diffusers, and they'll tell you . . . measure the *actual* air delivery—precisely and quickly—with an Alnor Velometer.**

**Balancing a Kno-Draft equipped installation is a fast and accurate process when using an Alnor Velometer. A few simple readings of the instrument and a twist of the wrist are all that is required to adjust the air flow to the desired amount.**

**The Velometer is the *only* instantaneous, direct-reading air velocity meter—accurate in all ranges, from high to low—compact, portable, easy to understand and use. Wide assortment of jets and fittings makes this precision instrument ideally suited for all air velocity measurement.**

**For your air measurement needs, get an Alnor Velometer. You'll save time and money wasted in balancing air distribution on your next installation. If you'd like a copy of the instructions on balancing Kno-Draft diffusers with the Alnor Velometer, just send the coupon below.**

**Illinois Testing Laboratories**
**Room 514, 420 N. LaSalle St.**
**Chicago 10, Ill.**

☐ **Send Kno-Draft Balancing Instructions**
☐ **Send Velometer Bulletin 2448-G**

**Name**.....

**Company**.....

**Address**.....

**City**.....**Zone**.....**State**.....

*Alnor* **PRECISION INSTRUMENTS FOR EVERY INDUSTRY**

# Gallons NOT GUESSES!

BUILDERS *Propeloflo*

the ideal propeller-type meter for measuring the actual flow of water in pipelines 2" to 36" and larger.

## FEATURES

**High Accuracy and Wide Range,** measuring within ± 2% of actual flow from about 10% to 100% of rated capacity.

**"Open Upper Limit",** temporary overload range of 150% of rated capacity.

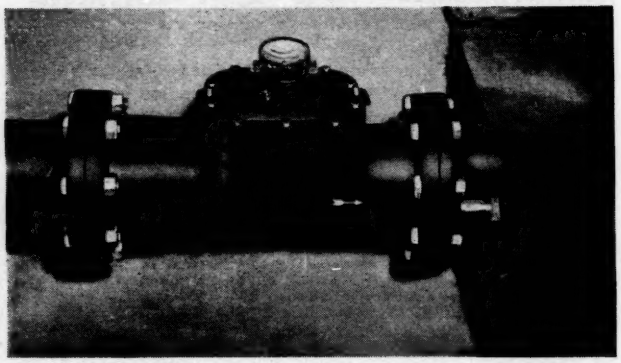
**As Easy to Install** as a valve or fitting.

**Low Loss-of-Head,** lower than most other types of flow meters.

**Secondary Instruments,** cable driven or electrically operated, for Totalizing, Indicating and/or Recording flow at nearby or remote locations.

**Intermittent Service,** where the line occasionally drains dry, Propeloflo registers accurately, without attention, when flow is resumed.

For complete information and Bulletin 380-G2A, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 469 Harris Ave., Providence 1, R. I.



BIF INDUSTRIES — BUILDERS PROVIDENCE *Instruments* — BUILDERS

Instruments for recording, indicating, and controlling flow, liquid level, pressure, and weight. Chlorinizers — chlorine gas feeders.


# COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

**ASME MEETING**—Spring meeting of the American Society of Mechanical Engineers, at the University of Washington, Seattle, Wash. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. .....**MARCH 24-26, 1952.**

**POWER CONFERENCE**—First annual American Power Conference (formerly named Midwest Power Conference), sponsored by Illinois Institute of Technology, at Hotel Sherman, Chicago. Conference Director, Roland A. Budenholzer at Illinois Tech, Technology Center, Chicago 16, Ill. ....**MARCH 26-28, 1952.**

**REMA MEETING**—Annual meeting of Refrigeration Equipment Manufacturers Association, at The Greenbrier, White Sulphur Springs, West Virginia. George E. Mills, public relations director, 1346 Connecticut Ave., N. W., Washington 6, D. C. **MARCH 26-28, 1952.**

**OIL HEAT EXPOSITION**—National Oil Heat Exposition, at Commercial Museum, Philadelphia, Pa., in conjunction with the 29th annual convention of Oil-Heat Institute of America, at the Benjamin Franklin Hotel. R. H. L. Becker, secretary, 6 E. 39th St., New York 16, N. Y. .....**APRIL 14-18, 1952.**

**OHI OLD TIMERS MEETING**—Annual jamboree of the Oil Timers Club of the Oil Burner Industry Inc., at the Lu Lu Temple, 313 South Broad St., Philadelphia, Pa., during Oil-Heat Institute Convention. H. A. Maccubbin, national secretary, 120 W. Madison St., Villa Park, Ill. ..**APRIL 15, 1952.**

**GAS APPLIANCE MEETING**—Annual meeting of the Gas Appliance Manufacturers Association at The Broadmoor, Colorado Springs, Colo. H. Leigh Whitelaw, managing director, 60 E. 42nd St., New York, N. Y. .....**MAY 21-23, 1952.**

**ASRE SPRING MEETING**—39th spring meeting of the American Society of Refrigerating Engineers at the Atlanta Biltmore Hotel, Atlanta, Ga. Secretary, M. C. Turpin, 40 W. 40th St., New York 18, N. Y. .....**JUNE 1-4, 1952.**

**NDHA MEETING**—Annual meeting of the National District Heating Association at Skytop Lodge, Skytop, Pa. John F. Collins, secretary of the Association, 827 N. Euclid Ave., Pittsburgh 6, Pa. ..... **JUNE 3-6, 1952.**

**CONTRACTORS CONVENTION**—163rd annual convention of the Heating, Piping and Air Conditioning Contractors National Association at the Statler Hotel, Boston, Mass. Joseph C. Fitts, secretary of the Association, 1250 Avenue of the Americas, New York 20, N. Y. .....**JUNE 10-13, 1952.**

**ASME MEETING** — Semi-annual meeting of the American Society of Mechanical Engineers, at the Sheraton Gibson Hotel, Cincinnati, Ohio. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. ..... **JUNE 15-19, 1952**

**ASHVE SPRING MEETING**—Semi-annual meeting of the American Society of Heating and Ventilating Engineers at The Essex and Sussex, Spring Lake, N. J. Executive Secretary, A. V. Hutchinson, 62 Worth St., New York 13, N. Y. **JUNE 16-18, 1952.**

**STOKER MEETING**—1952 annual meeting of the Stoker Manufacturers Association, at the South Shore Inn on Lake Wawasee near Syracuse, Indiana. Marc G. Bluth, executive secretary of the Association, 307 No. Michigan Ave., Chicago 1, Ill. .....**JUNE 22-24, 1952.**

**TESTING MATERIALS MEETING**—Annual meeting of the American Society for Testing Materials at the Hotel Statler, New York, N. Y. Secretary of the Society, 1916 Race St., Philadelphia 3, Pa. .....**JUNE 23-27, 1952.**

**ELECTRICAL ENGINEERS MEETING**—Summer general meeting of the American Institute of Electrical Engineers, at the Nicollet Hotel, Minneapolis, Minn. Secretary of the Institute, 33 West 39th St., New York 18, N. Y. ..**JUNE 23-27, 1952.**

**ASME MEETING**—Fall meeting of the American Society of Mechanical Engineers, at the Sheraton Hotel, Chicago, Ill. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. .....**SEPTEMBER 8-11, 1952.**

**AGA CONVENTION**—Annual convention of the American Gas Association, in the Auditorium, Atlantic City, New Jersey. Secretary of the Association, 420 Lexington Avenue, New York, N. Y. .....**WEEK OF OCTOBER 27, 1952.**

# I Wish All My Work Was As Foolproof As ALLENCO for Fire Protection

Architects, engineers and contractors choose ALLENCO 3 to 2 over next leading brand. Wide selection to meet every need. Easier to specify, estimate, install.

**Ready Reference in Sweet's Consulting Service from 25 offices**
**A.I.A. file 29e2 on request**

Established 1887
**W. D. ALLEN MANUFACTURING CO.**
CHICAGO 6 • NEW YORK 7

# AGITAIR® METER

## For Accurate Measurement of Air Velocity and Air Pressure

***Low Velocity Range: 0-750 fpm***
***High Velocity Range: 750-4000 fpm***
***Pressure Range: 0-4 inches water***

Based on the hot thermopile principle, the AGITAIR Meter gives instantaneous accurate measurements of air velocities as low as 5 fpm, and as high as 4000 fpm. It is inherently stable, does not waver or jerk and unlike many resistance type hot-wire instruments it is free from errors caused by temperature variations, radiation effects and lead resistance. For taking static pressure readings from 0 to 4" wg, a special attachment is provided. The simplicity and utility of the AGITAIR Meter make it useful for many diverse applications.

*Write for Bulletin AM-100*

**AIR DEVICES Inc.**
17 East 42nd Street New York 17, N. Y.
Air Diffusers • Air Filters • Exhausters

MAINTAINED SKIDMORE PUMPS EFFICIENCY

START HERE

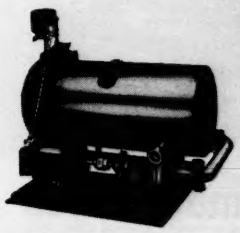
# Consult Skidmore

FOR A SPECIFIC PUMP REQUIREMENT

If you are faced with the responsibility of a choice, Skidmore offers many types and units for you to select the correct design to meet your individual requirements.

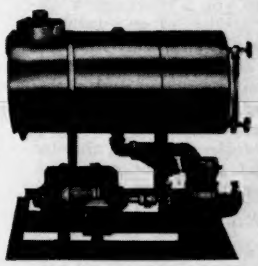
**Type UV Condensate Pump**

*Type UV Condensation Pump is designed for below floor level returns and is built in single and duplex units.*



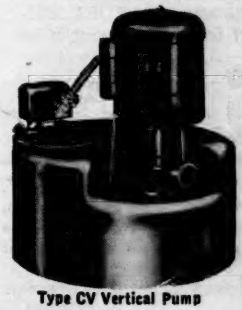
**Type HS Condensate Pump**

*Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 lbs. H. EDR and pressures from 10 to 75 pounds.*



**Type TM Turbine Pump**

*Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.*

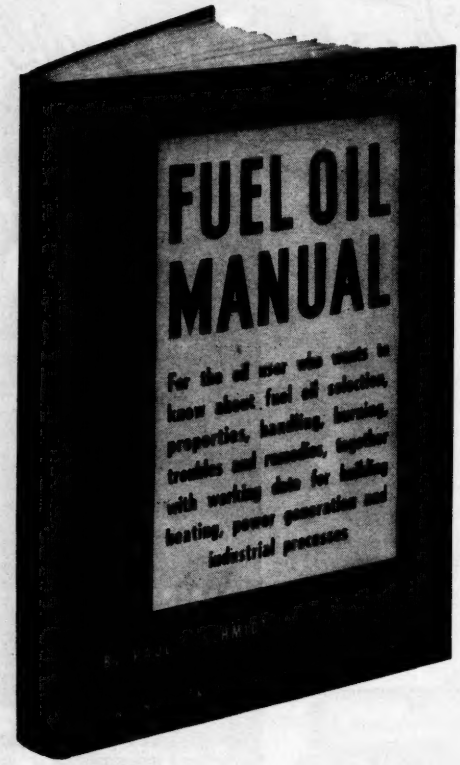


**Type CV Vertical Pump**

*Type CV vertical Pump is ideal where space is limited. This motor is easily accessible. Pump is built to meet severe requirements. For the power to [illegible] pump is built [illegible] Heating Pump Specialist.*

# Skidmore Pumps

**ST. JOSEPH, MICHIGAN**


FUEL OIL
MANUAL
For the oil user who wants to know about fuel oil selection, properties, handling, burning, troubles and remedies, together with working data for boiler heating, power generation and industrial processes

# Practical Information for Oil Buyers ... Sellers ... Users

Here's a new book that will give you a thorough working knowledge of fuel oil, its properties and uses! It gives a comprehensive picture of the characteristics and uses of every type and grade of fuel oil. The author explains the meaning of each oil property, and shows how this information is applied in selecting, handling and burning fuel oil. Fuel oil impurities and how they affect combustion are described fully. A special chapter describes fuel oil additives and how they are used. Another chapter lists troubles which may be encountered in using fuel oils and shows the correct remedy to apply in each case. Technical language is avoided wherever possible, and all terms used are fully explained.

FUEL OIL MANUAL is a valuable addition to your working library . . . Send for your copy today! SENT ON APPROVAL! If you wish to examine FUEL OIL MANUAL before you buy, send for it under our Five Day Free Inspection Plan.

160 Pages **$3.50** 34 Tables

Postpaid in U. S.

THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y.
Please send me . . . copies of FUEL OIL MANUAL at $3.50 each.

☐ I enclose $.....payment in full. (Money will be refunded if you decide not to keep the book and return it within five days.)

☐ Please send book postpaid. I will send payment in five days if I wish to keep the book.

NAME .....

COMPANY .....

STREET AND NO.....

CITY.....ZONE..... STATE.....

H & V 3-52


# DEGREE-DAYS FOR JANUARY, 1952

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING'S 24th Year of Publication of Monthly Degree-Day Data

| City | January | | |
|---|---|---|---|
| | 1952 | 1951 | Normal |
| Abilene, Texas (A) | 410 | 632 | 326 |
| Albany, New York (A) | 1196 | 1204 | 1387 |
| Albuquerque, New Mexico (A) | 800 | 874 | 924 |
| Alpena, Michigan (C) | 1271 | 1383 | 1431 |
| Anaconda, Montana (C) | 1309 | 1444 | 1321 |
| Asheville, North Carolina (C) | 634 | 807 | 831 |
| Atlanta, Georgia (C) | 479 | 602 | 682 |
| Atlantic City, New Jersey (C) | 803 | 822 | 992 |
| Augusta, Georgia (A) | 371 | 561 | 555 |
| Baker, Oregon (C) | 1282 | 1224 | 1218 |
| Baltimore, Maryland (C) | 755 | 806 | 955 |
| Billings, Montana (A) | 1398 | 1376 | 1318 |
| Binghamton, New York (C) | 1106 | 989 | 1268 |
| Birmingham, Alabama (A) | 422 | 447 | 589 |
| Bismarck, North Dakota (A) | 1961 | 1925 | 1807 |
| Block Island, Rhode Island (A) | 891 | 901 | 1048 |
| Boise, Idaho (A) | 1182 | 1107 | 1097 |
| Boston, Massachusetts (A) | 997 | 953 | 1150 |
| Bozeman, Montana (C) | 1430 | 1593 | 1403 |
| Buffalo, New York (A) | 1122 | 1124 | 1240 |
| Burlington, Iowa (A) | 1185 | 1315 | (a) |
| Burlington, Vermont (A) | 1361 | 1316 | 1429 |
| Butte, Montana (C) | 1405 | 1567 | 1309 |
| Cairo, Illinois (C) | 710 | 837 | 908 |
| Charleston, South Carolina (C) | 291 | 431 | 487 |
| Charlotte, North Carolina (C) | 530 | 662 | 725 |
| Chattanooga, Tennessee (A) | 546 | 695 | 732 |
| Cheyenne, Wyoming (A) | 1127 | 1308 | 1215 |
| Chicago, Illinois (C) | 1105 | 1196 | 1190 |
| Cincinnati, Ohio (C) | 780 | 902 | 1017 |
| Cleveland, Ohio (A) | 1012 | 1080 | 1181 |
| Columbia, Missouri (A) | 953 | 1053 | 1110 |
| Columbia, South Carolina (C) | 377 | 544 | 586 |
| Columbus, Ohio (C) | 902 | 1003 | 1113 |
| Concord, New Hampshire (A) | 1284 | 1229 | 1349 |
| Concordia, Kansas (C) | 1049 | 1163 | 1184 |
| Dallas, Texas (A) | 349 | 572 | 617 |
| Davenport, Iowa (C) | 1193 | 1346 | 1352 |
| Dayton, Ohio (A) | 971 | 1093 | 1116 |
| Deer Lodge, Montana (C) | 1416 | 1472 | 1376 |
| Denver, Colorado (C) | 927 | 1175 | 1079 |
| Des Moines, Iowa (A) | 1345 | 1380 | 1392 |
| Detroit, Michigan (A) | 1098 | 1148 | 1252 |
| Devils Lake, North Dakota (C) | 1987 | 2029 | 1949 |
| Dodge City, Kansas (A) | 893 | 1117 | 1116 |
| Dubuque, Iowa (C) | 1418 | 1483 | 1442 |
| Duluth, Minnesota (C) | 1746 | 1804 | 1727 |
| Eastport, Maine (A) | 1264 | 1176 | 1380 |
| Elkins, West Virginia (A) | 894 | 975 | 1048 |
| El Paso, Texas (A) | 482 | 634 | 629 |
| Ely, Nevada (A) | 1463 | 1221 | (a) |
| Erie, Pennsylvania (C) | 1013 | 1046 | 1172 |
| Escanaba, Michigan (C) | 1417 | 1506 | 1550 |
| Evansville, Indiana (A) | 822 | 969 | 949 |
| Fargo, North Dakota (A) | 1967 | 1981 | 1815 |
| Fort Smith, Arkansas (A) | 576 | 778 | 850 |
| Fort Wayne, Indiana (A) | 1067 | 1161 | 1194 |
| Fort Worth, Texas (A) | 360 | 583 | 580 |
| Fresno, California (A) | 606 | 598 | 583 |
| Galveston, Texas (C) | 117 | 295 | 353 |
| Grand Junction, Colorado (A) | 1171 | 1220 | 1233 |
| Grand Rapids, Michigan (A) | 1194 | 1252 | 1262 |
| Green Bay, Wisconsin (C) | 1492 | 1651 | 1538 |
| Greensboro, North Carolina (A) | 633 | 777 | 772 |
| Greenville, South Carolina (A) | 498 | 687 | 744 |
| Harrisburg, Pennsylvania (A) | 938 | 973 | 1088 |
| Hartford, Connecticut (A) | 1053 | 1046 | 1159 |
| Hatteras, North Carolina (C) | 469 | 504 | 589 |
| Havre, Montana (C) | 1769 | 1672 | 1624 |
| Helena, Montana (A) | 1620 | 1487 | 1375 |
| Houston, Texas (C) | 157 | 327 | 366 |
| Huron, South Dakota (A) | 1720 | 1671 | 1650 |
| Indianapolis, Indiana (A) | 981 | 1105 | 1128 |
| Jackson, Mississippi (A) | 331 | 486 | (a) |
| Kansas City, Missouri (A) | 958 | 1057 | 1141 |
| Knoxville, Tennessee (A) | 571 | 708 | 815 |
| La Crosse, Wisconsin (A) | 1504 | 1670 | 1535 |
| Lander, Wyoming (A) | 1348 | 1375 | 1436 |

(a) Data not available.

| City | January | | |
|---|---|---|---|
| | 1952 | 1951 | Normal |
| Lansing, Michigan (A) | 1185 | 1250 | 1336 |
| Lewiston, Maine (O) | 1259 | 1262 | 1452 |
| Lincoln, Nebraska (C) | 1227 | 1300 | 1311 |
| Little Rock, Arkansas (A) | 529 | 671 | 719 |
| Livingston, Montana (C) | 1258 | 1323 | 1220 |
| Los Angeles, California (C) | 371 | 298 | 326 |
| Louisville, Kentucky (A) | 792 | 895 | 939 |
| Lynchburg, Virginia (A) | 701 | 835 | 856 |
| Macon, Georgia (A) | 319 | 469 | 549 |
| Madison, Wisconsin (C) | 1346 | 1528 | 1500 |
| Marquette, Michigan (C) | 1398 | 1455 | 1500 |
| Memphis, Tennessee (A) | 542 | 682 | 744 |
| Meridian, Mississippi (A) | 334 | 500 | 552 |
| Milwaukee, Wisconsin (A) | 1293 | 1375 | 1383 |
| Minneapolis, Minnesota (A) | 1629 | 1721 | 1609 |
| Moline, Illinois (A) | 1232 | 1372 | (a) |
| Montgomery, Alabama (A) | 320 | 424 | 515 |
| Nantucket, Massachusetts (A) | 929 | 898 | 1026 |
| Nashville, Tennessee (A) | 636 | 763 | 812 |
| New Haven, Connecticut (A) | 989 | 1011 | 1110 |
| New Orleans, Louisiana (C) | 145 | 236 | 332 |
| New York, New York (C) | 880 | 877 | 1028 |
| Nome, Alaska† (A) | (a) | 1720 | 1857 |
| Norfolk, Virginia (C) | 559 | 596 | 738 |
| North Head, Washington (C) | 768 | 731 | 725 |
| North Platte, Nebraska (A) | 1143 | 1251 | 1300 |
| Oakland, California (C) | 568 | 510 | 527 |
| Oklahoma City, Oklahoma (C) | 624 | 776 | 865 |
| Omaha, Nebraska (A) | 1320 | 1380 | 1355 |
| Oswego, New York (C) | 1155 | 1146 | 1277 |
| Parkersburg, West Virginia (C) | 802 | 889 | 992 |
| Peoria, Illinois (A) | 1163 | 1254 | 1283 |
| Philadelphia, Pennsylvania (C) | 817 | 848 | 962 |
| Phoenix, Arizona (C) | 399 | 370 | 409 |
| Pittsburgh, Pennsylvania (C) | 858 | 989 | 1054 |
| Pocatello, Idaho (A) | 1368 | 1271 | 1218 |
| Portland, Maine (A) | 1280 | 1220 | 1321 |
| Portland, Oregon (C) | 842 | 757 | 806 |
| Providence, Rhode Island (C) | 950 | 929 | 1116 |
| Pueblo, Colorado (A) | 879 | 1139 | 1060 |
| Raleigh, North Carolina (C) | 517 | 642 | 722 |
| Rapid City, South Dakota (A) | 1311 | 1367 | 1320 |
| Reading, Pennsylvania (C) | 886 | 911 | 1088 |
| Red Bluff, California (A) | 711 | 647 | (a) |
| Reno, Nevada (A) | 1198 | 980 | 1042 |
| Richmond, Virginia (C) | 657 | 722 | 831 |
| Rochester, New York (A) | 1149 | 1158 | 1252 |
| Roswell, New Mexico (A) | 592 | 820 | 786 |
| Sacramento, California (C) | 644 | 579 | 614 |
| St. Joseph, Missouri (A) | 1077 | 1158 | 1187 |
| St. Louis, Missouri (C) | 856 | 981 | 1060 |
| Salt Lake City, Utah (A) | 1170 | 1092 | 1110 |
| San Antonio, Texas (A) | 212 | 443 | 381 |
| San Diego, California (A) | 321 | 287 | 332 |
| Sandusky, Ohio (C) | 986 | 1068 | 1181 |
| San Francisco, California (C) | 519 | 450 | 465 |
| Sault Ste. Marie, Michigan (A) | 1465 | 1563 | 1581 |
| Savannah, Georgia (A) | 273 | 441 | 409 |
| Scranton, Pennsylvania (C) | 1057 | 1037 | 1172 |
| Seattle, Washington (C) | 774 | 758 | 781 |
| Sheridan, Wyoming (A) | 1389 | 1409 | 1431 |
| Shreveport, Louisiana (A) | 327 | 513 | 555 |
| Sioux City, Iowa (A) | 1454 | 1480 | 1435 |
| Spokane, Washington (A) | 1281 | 1168 | 1172 |
| Springfield, Illinois (C) | 1028 | 1100 | 1181 |
| Springfield, Missouri (A) | 854 | 964 | 973 |
| Syracuse, New York (A) | 1182 | 1182 | 1277 |
| Tacoma, Washington (C) | 805 | 810 | 812 |
| Terre Haute, Indiana (A) | 967 | 1080 | 1070 |
| Toledo, Ohio (A) | 1053 | 1147 | 1203 |
| Topeka, Kansas (C) | 999 | 1072 | 1135 |
| Trenton, New Jersey (C) | 879 | 902 | 1014 |
| Utica, New York (O) | 1263 | 1205 | 1248 |
| Valentine, Nebraska (C) | 1387 | 1398 | 1370 |
| Walla Walla, Washington (C) | 1051 | 905 | 989 |
| Washington, D. C. (C) | 750 | 774 | 970 |
| Wichita, Kansas (A) | 879 | 1010 | 1094 |
| Williston, North Dakota (C) | 1841 | 1835 | 1805 |
| Winnemucca, Nevada (C) | 1155 | 1050 | 1150 |
| Yakima, Washington (A) | 1360 | 1127 | 1159 |

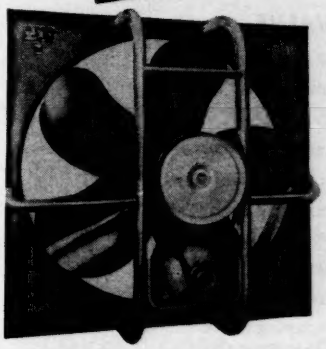
(a) Data not available. †Nome data are for December.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.


INCREASE your production with efficient—

CHELSEA INDUSTRIAL FANS

—A TYPE FOR EVERY APPLICATION!



CHELSEA TYPE IND EXHAUST FAN
For factories, mills, theatres, schools, hotels and churches. Features belt drive with ball bearing motor and fan shaft. Sizes from 24" to 72".

TYPE MC MANCOOLER BELT DRIVEN

TYPE PLP POWER LINE EXHAUST FAN

TYPE BB ALL PURPOSE EXHAUST FAN

TYPE PHD PENTHOUSE UNIT

TYPE PLDX POWER LINE DUCT BOOSTER

TYPE PLDA POWER LINE AIR BLASTER

STEP-UP OUTPUT and quality of workmanship, reduce industrial accidents and employee fatigue with proper ventilating and cooling equipment. CHELSEA Fans remove excessive heat, fumes, dirt, dust and grit, also dead stale air. 30 models, in over 200 sizes, are available, and each fan or blower is especially engineered and tested for its recommended applications. All ratings are certified by P.F.M.A. test methods to insure proper performance. Check on your ventilating requirements, now.

NEW CATALOG No. 400 now available!
Complete data and specifications on fans and blowers for every industrial and commercial application—address requests to Dept. M-3.

PROPER VENTILATION IS AN INVESTMENT!
Look for this Symbol of Quality . . . →
← Look for this Seal of Certified Ratings

CHELSEA

CHELSEA FAN & BLOWER CO., Inc.
PLAINFIELD NEW JERSEY

FOR BETTER VALVE AND UNION PERFORMANCE:

# FAIRBANKS *All Star Team*

An unbeatable combination — the "first string" team of valve and union for dependable trouble-free piping installations.

***Look at the lineup:***

**U-01 BRONZE GLOBE VALVE**

★ Renewable Composition Disc

Perfect sealing at all times—

A disc for every type of service—

#50—a hard disc for general usage

#52—a rubber disc for cold water valves

#60—a special synthetic disc highly resistant to gasoline, oils and many acids and alkalies.

★ Two Piece Union Bonnet

—Quick, easy disassembly

—No sliding or scraping between body and bonnet—NO WEAR

★ Radial Seat of Two Piece Union Bonnet

—Leak-proof Body Bonnet Joint

—Rigid alignment of all parts—guaranteed perfect seating all the time.

**DART UNION**

★ Ground Ball Joint having extra wide seating surfaces

★ Two Bronze Seats, non-corroding, on both sides of the seat

★ Leak-proof without excessive torque because of true bearing surfaces

★ High-test air-refined malleable iron body will not stretch, practically unbreakable.

THE **Fairbanks** COMPANY

393 LAFAYETTE STREET • NEW YORK 3, N. Y.

Branches

New York 3 • Pittsburgh 25 • Boston 10 • Rome, Ga.

**VALVES • DART & PIC UNIONS • TRUCKS • CASTERS**

# NEW SKINNER DEVELOPMENT

## for Domestic Oil Burners

## NEW V2-500 TIME DELAY VALVE

**HELPS ELIMINATE SOOT & BACKFIRES**

★

**SMALL & COMPACT WEIGHT ONLY 9 OZ.**

★

**SAFE & SURE**

★

**SAVES FUEL**

★

**UNDERWRITERS' APPROVED**

★

**LOW COST**

★

**PROMPT DELIVERY**

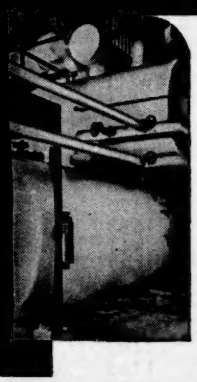
This outstanding new Skinner development promises new customer satisfaction whether installed on new or old oil burners. The V2-500 operates as follows: After blower, motor and pump start, the valve delays 5 to 6 seconds before releasing oil. At end of heating cycle, valve closes instantly preventing combustion while motor, pump and fan coast to a stop. This assures adequate air volume at start of combustion cycle, improves draft and helps eliminate sooty conditions. Valve is two-way normally closed; rated at 115 p.s.i. max. Coil is continuous duty rated at 9 watts max. Write for details and low prices!

SKINNER ELECTRIC VALVES®

THE SKINNER CHUCK COMPANY

136 Belden Ave., Norwalk, Conn.

## HERE'S YOUR COVER FINISH



No need to sew covers onto insulation. Cementing saves time, costs less. Arabol Lagging Adhesive—developed for war needs—now meets all requirements on installations of all sizes. Easily applied, dries quickly, requires no painting. Write for Bulletin #52.

THE ARABOL MANUFACTURING CO.

110 East 42nd St., New York 17, N. Y.
1835 S. 54th Ave., Chicago 50, Ill.
1950 16th St., San Francisco 3, Cal.

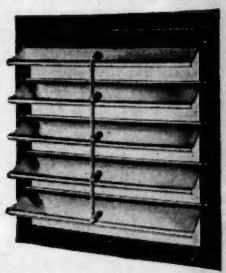
ARABOL

## Elgo Ventilating Specialties

### More Efficient Automatic Shutter

**Unusually sensitive to air currents, yet the shutters fit with a snugness never before achieved in an automatic shutter, and are rattle-proof. Completely weatherstripped around the inner edge of the frame. Sizes from 12" to 72"—also rectangular.**

WRITE FOR CIRCULAR AND PRICES



"ELGO" TYPE AUTOMATIC SHUTTER Front View (Open)

Free CATALOG

ELGO SHUTTER & MANUFACTURING CO.

2738 W. Warren Detroit 8, Mich.

*Pur Air* **ACTIVATED COCONUT SHELL CARBON**

# WILL REMOVE ODORS

## and make "used air" — "Fresh Air"

**Pur Air — represented by people you know...**

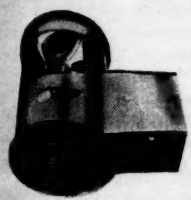
Albany, New York, F. R. Foote Co., Inc.
Albuquerque, N.M., Boyd Engineering Co., Inc.
Amarillo, Texas, Snook & Aderton, Inc.
Atlanta, Georgia, Crawley-Gorbant Co.
Baltimore, Md., Lancaster, May & Co.
Binghamton, N.Y., Dudley W. Gregg
Birmingham, Ala., S. C. Bratton
Boston, Mass., L. R. Geissenhainer
Buffalo, N.Y., Van Ness Harwood Co.
Butte, Mont., Sullivan Valve & Engr. Co.
Charleston, W. Va., Engineering Products Co.
Charlotte, N.C., Robert E. Mason & Co.
Chicago, Ill., Zintel, Byfield & Co.
Cincinnati, O., Russell R. Gannon Co.
Cleveland, Ohio, Dan B. Billington
Columbus, Ohio, Russell R. Gannon Co.
Corpus Christi, Texas, L. S. Pawkett & Co.
Dallas, Texas, W. E. Lewis and Co.
Dayton, Ohio, Russell R. Gannon Co.
Denver, Colorado, E. P. Murr
Detroit, Mich., George Q. McNamara, Inc.
El Paso, Tex., Boyd Engineering Co.
Fort Wayne, Ind., Jones Engineering Prod.
Hammond, Ind., Zintel, Byfield & Co.
Houston, Tex., Jack Thomas Davis
Indianapolis, Ind., Russell R. Gannon Co.
Kansas City, Mo., Manufacturers' Sales Co.
Little Rock, Ark., J. C. Lewis Company
Los Angeles, Cal., Hess, Greiner & Polland
Louisville, Ky., Russell R. Gannon Co.
Lubbock, Tex., Snook & Aderton, Inc.
Memphis, Tenn., J. B. Lammons
Miami, Florida, Stuart G. Pizie
Milwaukee, Wis., Zintel, Byfield & Co.
Nashville, Tenn., S. C. Bratton
Newark, N.J., John B. Hewett Co., Inc.
New York, N.Y., John B. Hewett Co., Inc.
Norfolk, Va., Laurence Trant & Co.
Oklahoma City, Okla., J. M. O'Connor Co.
Omaha, Nebraska, D. E. McCulley
Peoria, Ill., Zintel, Byfield & Co.
Philadelphia, Pa., George F. Bertrand Co.
Phoenix, Ariz., Boyd Engineering Co.
Pittsburgh, Pa., E. J. Deckman Co.
Portland, Maine, A. E. Wallgren
Portland, Ore., T. C. Langdon Co.
Rochester, N.Y., A. R. Bowman Co.
Rockford, Ill., Zintel, Byfield & Co.
St. Paul, Minn., Thermal Co., Inc.
Salt Lake City, Utah, Williams, Gritton & Wilde
San Antonio, Tex., L. S. Pawkett & Co.
San Francisco, Cal., E. C. Cooley Co.
Seattle, Wash., E. H. Langdon Co.
Spokane, Wash., Sullivan Valve & Engr. Co.
Toledo, Ohio, Eyster Engineering Co.
Tulsa, Okla., J. M. O'Connor Co.
Washington, D.C., Lancaster, May & Co.
Wichita, Kansas, J. M. O'Connor Co.

**PUR AIR DIVISION • AMERICAN SOLVENT RECOVERY CORP. • COLUMBUS 3, OHIO**

**STAXAUSTER** can be used to convert all types of roof ventilators into powerful exhaust or air supply units.

*allen*

**EXHAUST FANS**



**Remote Drive Allen Staxauster**
Specially designed for applications handling corrosives and/or high-temperature air.

Allen-engineered Exhaust Fans are efficient, easy to install, and economical to operate. The Fan Section shown above and the Remote Drive Staxauster present a range and diversity that enable you to solve almost any ventilating problem. For your wall installation needs, Allen Exhaust Fans and Lo-Noiz-Level Multiblade Fans are recommended. Advanced engineering design, skilled workmanship, and quality materials make Allen Exhaust Fans outstanding in the ventilating field. Our representatives are in most principal cities; names listed in our catalog in Sweet's Architectural File, Section 20b.

**Write for catalog on complete line of roof ventilators.**

ALLEN ENGINEERED VENTILATION

**PRODUCTION PLANNING CO.**
ROCHESTER, MICHIGAN
Roof Ventilators for Every Commercial and Industrial Need



FOR INSTALLATIONS THAT STAY...

*SMOOTH and SILENT*

**Insure years of silent efficiency from your air conditioning and blower installations with Ahlberg ED and EDR Series Pillow Blocks. Designed and manufactured by a staff long famous for industrial precision and ruggedness, they combine these qualities with compactness, light weight and low cost. For power installations that *stay right*, insist on Ahlbergs. Write for catalog today.**

**AHLBERG BEARING COMPANY**
**3025 W. 47th Street**
**Chicago 32, Ill.**

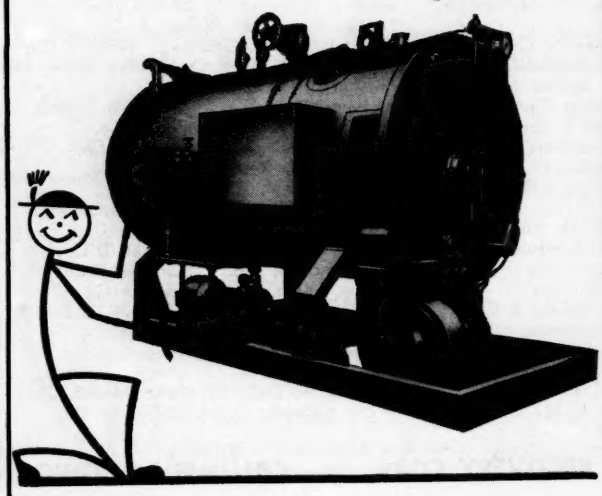
**EDR SERIES Rubber Insulated PILLOW BLOCKS. Shaft sizes: ½" to 1"**

**ED SERIES PILLOW BLOCKS. Shaft sizes: ½" to 1 15/16"**

AHLBERG PRECISIONEERED
Anti-Friction Products Since 1908

# AMESTEAM GENERATOR

## JUST SET IT ON YOUR BOILER ROOM FLOOR!



**NEEDS NO** { FOUNDATIONS / BRICKWORK / LARGE STACK

**You Supply Fuel Tank, Gas Vent and Service Connections . . . We Supply the Rest**

**Nineteen Sizes . . . 10 to 500 h.p.**
**15# to 200# w.p.**
**OIL or GAS**

***WRITE FOR BULLETIN 1011-C***

# AMES IRON WORKS

**BOX H-3 OSWEGO, N. Y.**

***Builders of Better Boilers Since 1848***

## How to promote greater PER-MAN productivity!

**Well-ventilated working environments contribute to faster, better defense production.**

**Western Rotary Turbine Ventilators provide constant, round-the-clock exhaust *without* power. A 2-mph breeze keeps your Western Rotary System in operation. Lifetime guaranteed bearings are both mounted on the same axis . . . always stay in alignment. Throat sizes 6" through 48", with the clean, low silhouette progressive industry demands.**

**Complete, up-to-the-minute information, sizes, capacities, and prices on all Western equipment upon request. In 1952 SWEETS and A.E.C.**

**Available from your favorite wholesaler's stock**

*"ALWAYS ON THE JOB — NEVER ON THE PAYROLL"*

## WESTERN ENGINEERING & MFG. CO.

1726-28 E. WASHINGTON BLVD., LOS ANGELES 21, CALIF.

## H & K GRILLE PATTERNS

**Though restrictions limit the use of some metals and certain plated finishes, we still offer a wide selection of grille patterns in available metals, plastics, masonite, plywood and other sheet materials.**

**With H & K GRILLES you will find the answer to the problems of . . .**

**. . appearance**
**. . . protection**
**. . . ventilation**
**. . . sound escape**
**. . . acoustical absorption**

**In addition to our decorative designs, you may also select round and slotted hole patterns from our large range of sizes and spacings.**

**H & K GRILLE patterns are furnished in sheets or in special sizes and shapes to meet your requirements. We are equipped to shear, form, weld or braze as may be required.**

***Tell us of your needs and permit us to recommend and quote.***

**The Harrington & King PERFORATING CO.**

**5664 Fillmore St., Chicago 44, Ill.**
**114 Liberty St., New York 6, N. Y.**

# CLASSIFIED ADVERTISING

## FOR SALE

**10—250,000 C.F.M. Buffalo ventilating fans—type LLD, double width, size 15, class 1, clockwise rotation, top horizontal discharge, arrangement 3, with sleeve bearings. Excellent condition.**

**HARVEY MACHINE CO., INC.**
**19200 So. Western Avenue**
**Torrance, California**
***Phone: NEvada 6-2111***

AIR DRYER BARGAIN
Humid time coming, protect now, with this bargain unit: A PITTSBURG LECTRODRYER, complete with humidistat, solenoid, automatic/manual control, Model CHG, 350cfm. Serial 2181—guaranteed in mechanically perfect condition. $300.00. WILLIAMS & COMPANY, Eureka Springs, Ark.

MANUFACTURERS' AGENTS—REPRESENTATIVES WANTED
Appoint distributors for new gas garbage disposal unit. Sales support through national advertising and complete promotion program. Good following and extensive experience required. Submit details and references. Liberal commission. Box 743, HEATING AND VENTILATING, 148 Lafayette St., New York 13, N. Y.

POSITION OPEN—Shop Foreman for Sheet Metal Contractor doing industrial ventilation, air conditioning, blow pipe and exhaust work. Thorough knowledge of trade required, including ability to measure and sketch. Salary to $8,000.00. Box No. 741, HEATING AND VENTILATING, 148 Lafayette St., New York 13, N. Y.

"THE E. L. BRUCE CO. WAY"
Floor maintenance products for industrial-institutional-commercial trade. Joseph A. Farrell, 687 Concord Avenue, Cambridge 38, Mass. Tel. K17-1049. Descriptive literature upon request. Brushes-Paints-Sundries.

ALL-WEATHER ALUMINUM HOLDERS
All sizes for truck meter tickets. Keep drivers' tickets clean. Send sample of your ticket and we will furnish proper size holder.
DEGREE-DAY SYSTEMS, WOODSIDE, N. Y.

**Heating and Ventilating's**
**Engineering Databook**
**An Authoritative**
**Reference Book**
For Heating Engineers — Estimators — Air Conditioning Engineers — Ventilating Engineers—Architects—Piping Engineers — Contractors — Plant Engineers — Operating and Maintenance Engineers

**THE INDUSTRIAL PRESS**
**148 Lafayette St. New York 13**


# KENNEDY

**bronze globe and angle valves . . .**

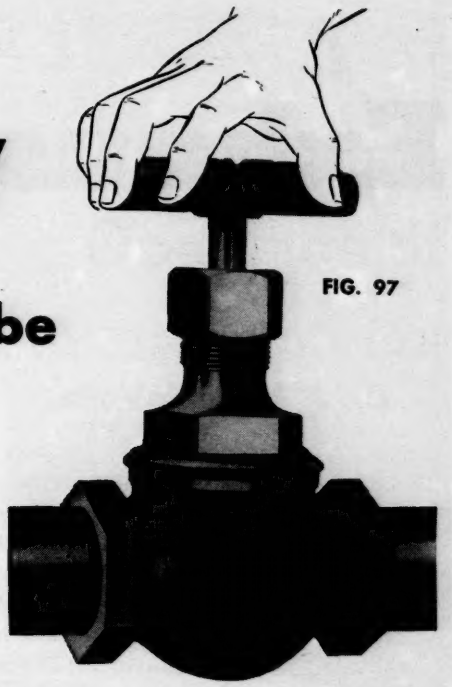


FIG. 97

**JOB-FITTED with the *right* disc for every service**

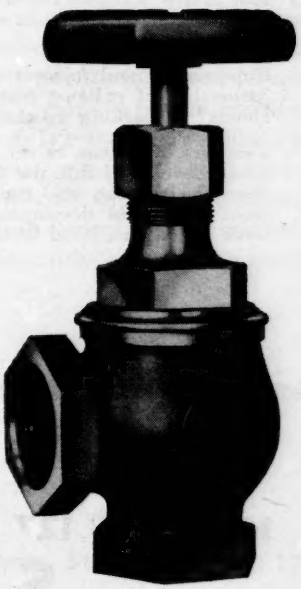


FIG. 98

**TO ASSURE LONG, TROUBLE-FREE OPERATION** with easy maintenance, the complete KENNEDY Line is *job-fitted* . . . every valve specially designed and engineered for the job it has to do.

**IN THE KENNEDY FIGS. 97 and 98,** for example, the disc is exactly matched to the job. To meet a wide range of fluid, temperature and pressure requirements, a variety of disc materials is available. Each is carefully selected for the service for which it is recommended.

**THE RENEWABLE COMPOSITION DISCS** give longer service because the extra height of the raised seats utilizes full thickness of the disc before replacement is necessary. The disc holder swivels on the stem to allow uniform wear on the disc.

**THE MOLDED PACKING** is self-lubricating and both Fig. 97 and Fig. 98 can be readily repacked under full pressure.

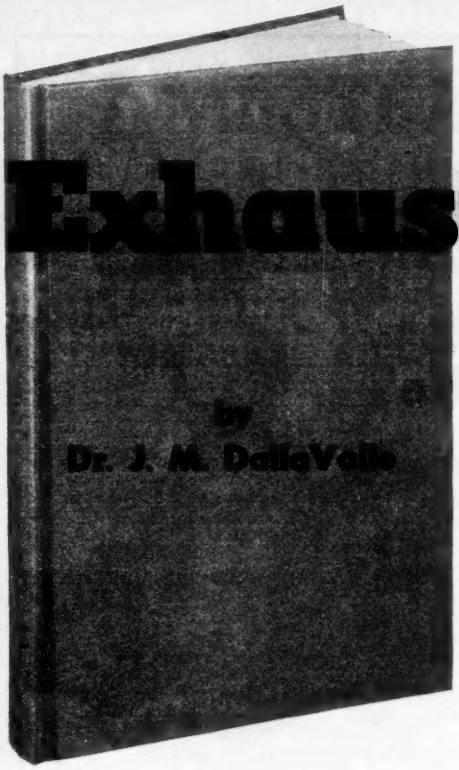
**THE HEAVY-WALLED BODIES** are ruggedly built with full rounded contour. The stems are made with manganese bronze of 50,000 lb. tensile strength and have unusually heavy threads. Parts are fully interchangeable. Sizes range from ¼ to 3 inches with a working pressure of 125 lbs. saturated steam, WRITE FOR BULLETIN 56.

***BUY FROM YOUR LOCAL DISTRIBUTOR***

Est. 1877

**THE KENNEDY VALVE MFG. CO. • ELMIRA, N.Y.**

VALVES • PIPE FITTINGS • FIRE HYDRANTS




# Exhaust Hoods » » »

## Who Can Use this Book?

**"Exhaust Hoods" will be useful to *ventilation engineers* and *industrial hygienists* who are called upon to design exhaust systems with definite control at the source of atmospheric contamination by dust, mist, fumes, vapors and gases.**

***Students,* particularly those engaged in graduate study, will find in "Exhaust Hoods" an authoritative treatment of fundamentals based on the author's many years of practical experience.**

***Engineers* with occasional problems in exhaust ventilation will be able to use "Exhaust Hoods" as a means of quickly finding accurate information on a subject with which they may not be completely familiar.**

***Government* and *insurance officials* who are responsible for the inspection of exhaust installations will be able to use "Exhaust Hoods" in backing up their reports and decisions.**

***Teachers* of courses in ventilation, at either the university or trade school level, will find the discussion of fundamentals in "Exhaust Hoods" clear cut, and the examples of hood design applications most helpful in developing a competent background for actual work in exhaust hood design.**

## CONTENTS

CHAPTER

1. Theory of Flow of Gases Into an Opening
2. Velocity Characteristics of Common Types of Unobstructed Openings
3. Velocity Contours of Hoods with Special Boundary Conditions
4. Criteria for Determining Hood Effectiveness
5. Canopy Type Hoods
6. Hoods for Dust and Mist Control: Total Enclosures and Screening
7. Hoods for Dust Control: Partial Enclosures for Grinding
8. Hoods for Dust Control: Miscellaneous
9. Hoods for Control of Fumes, Vapors and Gases
10. Booth-like Structures for Fumes, Vapors and Gases
11. Grille-Type Openings Under Section
12. Hoods for Woodworking Machinery
13. Examples of Hood Design Calculations
14. Hood Entrance Losses
15. Essentials of Hood Construction

**141 Pages 127 Illustrations 30 Tables**

**$3.50**

Postpaid in U. S. Canadian or Foreign Postage—35¢

***Send For Your Copy Today!***

**If you wish to examine "Exhaust Hoods" to see whether or not you can use it, you may send for it under our Five Day Free Inspection Plan. Just mail the coupon at the right and the book will be sent postpaid at once. If you decide to keep "Exhaust Hoods" you may pay within five days.**

# The Only Book Published Covering Air Flow Around and Into Openings of Hoods and Slots in Exhaust Systems

**If you are looking for information on exhaust hood design, this is the only book published that gives comprehensive information on the flow of air around and into the openings, hoods, or slots in exhaust ventilating systems. Written by Dr. J. M. DallaValle, who has had over twenty years' experience in the field of industrial hygiene, it is a concise assembly of both fundamental theory (including the latest thinking along the lines of what is known as the dilution concept) and of practical applications of theory to the actual design of hoods for all types of industrial installations. Originally published in pamphlet form as a report of the author's extensive research into the subject, the basic material has been coordinated with data by other investigators covering all phases of hood, booth and slot design.**

**Increased emphasis on industrial health hazards in plants where harmful and dangerous dusts, vapors, gases or fumes are generated has resulted in a demand for accurate design of exhaust systems, of which the hood is a most critical part. In "Exhaust Hoods" four chapters are devoted to the various aspects of theory, including flow of gases, velocity characteristics of canopy hoods, and criteria for determining hood effectiveness. Five chapters cover actual hood design for various types of applications. Other chapters cover booth-like structures, grille openings, woodworking machinery, examples of hood design calculations, entrance losses, and the essentials of good construction. Sample problems, with the solutions worked out in detail, are given in a chapter devoted entirely to this matter. There are 127 illustrations, many of which are photographs of actual hoods illustrating specific problems.**

**THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y.**

Please send me.....copies of EXHAUST HOODS at $3.50 each

Name .....

Company .....

Street and No. .....

City .....Zone.....State.....

Home Address .....

(Please fill in if you want book sent to your home)

City .....Zone.....State.....

**CHECK METHOD OF PAYMENT DESIRED**

☐ I enclose our Firm Purchase Order.

☐ I enclose $.....in check or money order in full payment. (Money will be refunded if you are not satisfied.)

☐ Send book postpaid. I will send payment in five days if I wish to keep the book.

H & V-3/52

# ALPHABETICAL INDEX OF ADVERTISERS


A

Acme Industries, Inc. ..... 16
Aerofin Corporation ..... *
Ahlberg Bearing Co. ..... 141
Air Conditioning Products Co. ..... 135
Air Devices, Inc. ..... 137
Air Filter Corp. ..... 130
Air-Maze Corp. ..... *
Airtherm Manufacturing Co. ..... 133
Alco Valve Co. ..... 51
Allen-Bradley Co. ..... *
Allen Ventilator Div., Production Planning Co. ..... 141
Allen, W. D., Manufacturing Co. .. 137
American Air Filter Co., Inc. ....13-29
American Blower Corp. ....Insert 17
American District Steam Co., Inc. .. 55
American Machine and Metals, Inc. 1
American Radiator & Standard Sanitary Corp. ..... 33
American Society of Heating & Ventilating Engineers ..... 61
American Society of Refrigerating Engineers ..... 127
American Solvent Recovery Corp. . 141
American Ventilating Hose Co. .. *
American Wheelabrator & Equipment Corp. ..... 129
Ames Iron Works ..... 142
Anderson, V. D., Co. ..... *
Anemostat Corp. of America .... *
Arabol Manufacturing Co. ..... 140
Armstrong Machine Works ..... *
Auer Register Co. ..... 135

B

Babcock & Wilcox Co. ..... 37
Barber-Colman Co. ..... 52
Bell & Gossett Co. ..... *
Bethlehem Steel Co. ..... 113
Binks Manufacturing Co. ..... *
Bishop & Babcock Mfg. Co. ..... 129
Breidert, G. C., Co. ..... *
Brunner Manufacturing Co. ..... 5
Buffalo Forge Co. ..... 11
Builders-Providence, Inc. ..... 136
Bundy Tubing Co. ..... 47
Byers, A. M., Co. ..... 7

C

Carrier Corp. ..... 14
Chase Brass & Copper Co. ..... *
Chelsea Fan & Blower Co., Inc. .. 139
Chicago Pump Co. ..... 32
Clarage Fan Co. ..... *
Classified Advertisements ..... 143
Cleaver-Brooks Co. ..... 31
Combustion Engineering-Superheater, Inc. ..... 53
Committee on Steel Pipe Research . 18
Connor, W. B., Engineering Corp. . 19
Coyne & Delany Co. ..... *
Crane Co. ..... 28
Curtis Refrigerating Machine Div., Curtis Manufacturing Co. ..... *

D

Davis Engineering Corp. ..... 123
DeBothezat Fans Div. American Mch. & Metals, Inc. ..... 1
Delco Products Div., General Motors Corp. ..... *
Dollinger Corporation ..... 24
Dravo Corporation ..... 117
Dunham, C. A., Co. ..... *
Durant Insulated Pipe Co. ..... *

E

Eclipse Fuel Engineering Co. ..... *
Electromode Corp. ..... 25
Elgo Shutter & Mfg. Co. ..... 140
Emerson Electric Manufacturing Co. 12

F

Fairbanks Co. ..... 140
Farr Company ..... 8
Fasco Industries, Inc. ..... *
Fedders-Quigan Corp. .....48-49
Field Control Div., H. D. Conkey & Co. ..... 63
Fitzgibbons Boiler Co., Inc. ..... *
Flexonics Corporation ..... 30

G

Gallaher Company ..... *
General Controls Co. ..... 9
Golden Anderson Valve Specialty Co. ..... *
Grinnell Co., Inc. ....Inside Front Cover

H

Harrington & King Perforating Co. 142
Hays Corporation ..... 129
Henry Valve Co. ....Inside Back Cover
Hoffman Specialty Co. ..... *

I

Illinois Engineering Co. ..... 36
Illinois Testing Laboratories, Inc... 135
Industrial Sound Control, Inc. .... *
Industrial Press .....56-144-145
Infra Insulation, Inc. ..... 65
Iron Fireman Manufacturing Co. .. 10

J

Jenkins Bros. ..... *
Johnson Service Co. ..... *
Joy Manufacturing Co. ..... *

K

Kennard Corporation ..... *
Kennedy Valve Mfg. Co. ..... 143
Koppers Company, Inc. ..... *
Kramer Trenton Co. ..... *
Kritzer Radiant Coils, Inc. ..... *

L

Ladish Co. ..... *

M

Marley Company, Inc. ..... *
Marlo Coil Co. ..... *
Marsh Heating Equipment Co. ... 54
McCord Corporation ..... *
McDonnell & Miller, Inc. ...Back Cover
McQuay, Inc. ..... 59
Mercoid Corporation ..... 123
Midland Industrial Finishes ..... 123
Minneapolis-Honeywell Regulator Co. .....42-43
Modine Manufacturing Co. ..... 45
Muckle Mfg. Co. ..... 134
Mueller Brass Co. ..... 21

N

Nash Engineering Co. ..... 66
National Tube Div. ..... *
Nelson Herman Div. American Air Filter Co. Inc. .....124-125
Niagara Blower Co. ..... 126
Nicholson, W. H., & Co. ..... 134

O

Olson, Arthur A., & Co. ..... 131
Oran Company ..... 34
Owens-Corning Fiberglas Corp. ... *

P

Powers Regulator Co. ..... 39
Pritchard, J. F. & Co. .....26-27
Production Planning Co. ..... 141
Pyle-National Co. ..... 38

R

Remington Arms Co. ..... *
Revere Copper & Brass, Inc. ..... 111
Ric-wiL Company ..... 131

S

Sarco Co., Inc. ..... 23
Sarcotherm Controls, Inc. ..... 22
Skidmore Corporation ..... 137
Skinner Electric Valve Div., Skinner Chuck Co. ..... 140
Spence Engineering Co., Inc. .... 44
Standard Stamping & Perforating Co. 127
Sturtevant Div., Westinghouse Electric Corp. ..... *
Superior Combustion Industries, Inc. *
Swartwout Co. ..... 133

T

Taylor Forge & Pipe Works ..... 15
Thrush, H. A., & Co. ..... 20
Titusville Iron Works Co. Div., Struthers Wells Corp. ..... 132
Trane Co. ..... 115
Tuttle & Bailey Inc. .....40-41
Typhoon Air Conditioning Co., Inc. 58

U

U. S. Steel Co. ..... *
Union Asbestos & Rubber Co. ....119
Unistrut Products Co. ..... *

W

Wagner Electric Corp. ..... *
Want Advertisements ..... 143
Warren Webster & Co. ..... 2
Watts Regulator Co. ..... *
Weil Pump Co. ..... *
Western Engineering & Mfg. Co. .. 142
Westinghouse Electric Corp. ..... 57
Wing, L. J., Mfg. Co. ..... 121
Worthington Pump & Machinery Corp. ..... 46

Y

Yarnall-Waring Co. ..... 35
York Corporation ..... 60
York-Shipley, Inc. ..... 128
Young Radiator Co. ..... *
Youngstown Sheet & Tube Co. ... 50


*Advertisement appeared in preceding issue.

# POINTERS ON CENTRIFUGAL PUMP SELECTION

The following discussion of design features of centrifugal pumps was prepared by Edward J. Ackerman, Consolidated Edison Company, New York, as a guide in evaluating construction and design features of pumps so that the purchaser may receive maximum value. This discussion includes pump characteristics, bearings, shafts, and shaft sleeves, wearing rings, and impellers and casings.

## Pump Characteristics

First consideration should be an analysis of the pump characteristic curves submitted with the proposal. On these curves, the pumping head, horsepower and efficiency are plotted against capacity. Suitability of the pump for the specified capacity and head is readily established from these curves. Obviously, the pump with the best efficiencies in the operating ranges will require the least power. See the accompanying chart. High efficiency, however, while very desirable, must be considered in the light of the other factors.

For most applications, a centrifugal pump should have a constantly rising head curve from maximum capacity to "shut-off" at zero capacity. It will be noted from the typical pump curve that the pump has a definite capacity when pumping against a particular head. Should the head curve rise to a maximum point and then start to drop as it approaches shut-off, the pump will have two different capacities for the same head. This may cause the condition known as hunting, as the pump capacity shifts between the two ratings common to that pressure.

This condition becomes particularly undesirable when two or more pumps must operate in parallel. Instead of dividing the load evenly, each pump may operate at one of the capacities common to the head. Furthermore, each of the pumps may start hunting between the two capacities..

## Bearings

Most pump manufacturers have practically standardized on ball bearings. It is becoming increasingly difficult to obtain pumps of standard design equipped with babbitted sleeve-type bearings in spite of the fact that there are still many proponents of the latter type. There is, of course, much to be said for both types.

Ball bearings, being of shorter length than the sleeve type, permit pumps to be made with shorter shafts and correspondingly shorter over-all lengths. This may be advantageous where space is at a premium. With a shorter span, the shaft diameter may be reduced which permits an impeller of smaller over-all diameter. The effect of all this is a pump which, rating for rating, is smaller and less expensive to produce than a sleeve bearing pump.

With the ordinary care prescribed by the manufacturer, and using the grade of lubricant he recommends, ball bearings should give long uninterrupted service. The difficulties encountered in their use are generally not inherently the fault of the bearings, but in the manner of care given them.

The engineer, then, in choosing between ball or sleeve bearings should weigh cheaper first cost and greater compactness of the pumps against a simpler oiling regimen, cheaper bearing replacement costs, and greater pump availability due to shorter shutdowns caused by bearing failures.

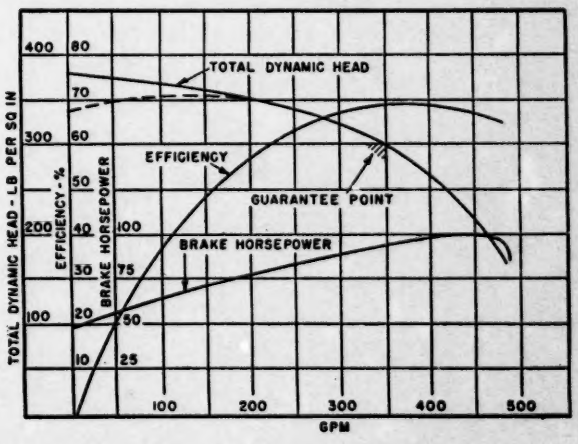
## Shafts and Shaft Sleeves

For pumping fresh water or non-corrosive fluids, a cold rolled carbon steel shaft should give good service. For brackish or salt water, stainless steel or Monel shafts should be considered in spite of their premium costs, if long and continuous service are prime factors. For other more corrosive fluids, the recommendations of the pump manufacturers' metallurgists should be enlisted.

Since shaft sleeves are rather generally employed to protect the shaft, one may question why expensive alloy shafts should ever be necessary. The answer is because sleeves seldom give 100% protection. Too few engineers seem to recognize that shaft breakage, a common cause of pump failure, is more often attributable to poorly fitted shaft sleeves than perhaps any other single cause. Most shaft sleeves are designed to butt against the hub of the impeller in a metal-to-metal joint and unless this is fitted to be fluid tight, the shaft will eventually break at this point, and which side goes first is only dependent on which side leaks worse.

Engineers cannot be too particular in considering the fit of the shaft sleeves, and they should not be lulled into a false sense of security by the inclusion of a non-metallic gasket. Such gaskets do not stand up under the severe strain of the service. When they deteriorate, the shaft becomes vulnerable.

Shaft sleeves are held in position by threads on the



shaft. When expansion and contraction is anticipated, the threaded sections are located adjacent to the impeller hub to permit expansion of the sleeves toward the free outer ends. Otherwise, some manufacturers locate the threads outside of the pump casing and hold the sleeves in place by threaded collars. For the sake of standardization, however, most designs conform to the first arrangement, and this often leads to a complication. Since the threads are in the field of the fluid pumped, they often become corroded, and sleeves are removed for replacement only with great difficulty. Therefore, it is not unusual to find it necessary to re-machine the shaft threads or even to replace the whole shaft.

Placing the threads external to the pump casing even when possible is not an ideal solution either. To prevent the sleeve from slipping on the shaft due to the pressure of the packing, the inside end is usually slotted around a shaft key. This invariably permits leakage around the key with attendant corrosion of the shaft.

The other function of shaft sleeves is to protect the shaft against the rubbing action of the packing where the shaft goes through the stuffing boxes. For the service both of the types of sleeves are satisfactory. In this connection, it might be mentioned, that a good deep stuffing box is better than a good shallow one. Some preference should be extended to the design that permits an additional ring or two of packing. Leakage through the stuffing box is controlled easier and the unit pressure on the sleeve is proportionately reduced.

### Wearing Rings

To avoid excessive internal leakage or by-passing of the fluid pumped, a small clearance must be retained between the pump casing and the hubs of the rotating impeller. Flow of the fluid through these internal passages is a cause of unavoidable wear. Most pumps are provided with replaceable casing or stationary wearing rings at these points which serve a double purpose. They protect the pump casing, and by replacement, permit the original clearances to be reestablished with resultant maintenance of pump efficiency.

Pumps are often provided with a set of companion rings on the impeller hubs and they are intended to serve the same functions.

Divided opinions are prevalent among operating engineers as to the value of the impeller wearing rings. The casing rings are usually easy to remove and replace and are a good investment in any pump. On the other hand, impeller rings are often difficult to loosen from the impeller and removal may cause sufficient damage to the impeller to make a ring replacement impossible without a great deal of machining. For this reason, manufacturers often eliminate the impeller rings on the assumption that it is more practical to dress the impeller hubs after wear has occurred, and replace the original casing rings with oversize rings to establish the original clearances.

Wearing rings are usually designed with a straight passage between the concentric faces, but some manufacturers favor the labyrinth or step design. In these types, the leakage, in passing from the pressure region to the eye of the impeller, has a relatively longer travel than in the straight-through type. The resistance to flow, therefore, is increased in the labyrinth type and less leakage is supposed to be sustained for any given clearance. Likewise, for the same leakage, it is claimed that wider clearances may be used.

Theoretically, it would be difficult to disprove these claims, but it has been the writer's experience that in actual practice, pumps equipped with labyrinth wearing rings do not show higher efficiencies than pumps not so equipped, nor do they necessarily hold their original efficiencies over longer periods.

The engineer, in evaluating these features of a pump, should insist on casing or stationary wearing rings. But if the application entails no unusual features or troublesome fluids, he should manifest unwillingness to pay a premium price for a pump simply because it is equipped with impeller rings or rings of the labyrinth type.

### Impellers and Casings

Impellers, even though the heart of the pump, seldom are a source of pump failure providing the pump is operated under proper suction conditions. When the pump suction connection is kept flooded under all conditions of operation to minimize cavitation, the impeller will give long continuous service. This assumes that the material of construction is suitable for the fluid pumped.

This may also be said for the pump casing. Practically the only requirement for long service is in the choice of a proper material for the fluid to be handled. One point of caution in this regard may not be amiss. Cast iron pipe generally has a satisfactory life for salt water lines, but cast iron pump parts will not stand up for this service. The surface film on an iron casting resists corrosion of salt water, but when this film is machined away, as it would do a pump casing or other parts, its service life is so reduced as to render it unsuitable.

shaft. When expansion and contraction is anticipated, the threaded sections are located adjacent to the impeller hub to permit expansion of the sleeves toward the free outer ends. Otherwise, some manufacturers locate the threads outside of the pump casing and hold the sleeves in place by threaded collars. For the sake of standardization, however, most designs conform to the first arrangement, and this often leads to a complication. Since the threads are in the field of the fluid pumped, they often become corroded, and sleeves are removed for replacement only with great difficulty. Therefore, it is not unusual to find it necessary to re-machine the shaft threads or even to replace the whole shaft.

Placing the threads external to the pump casing even when possible is not an ideal solution either. To prevent the sleeve from slipping on the shaft due to the pressure of the packing, the inside end is usually slotted around a shaft key. This invariably permits leakage around the key with attendant corrosion of the shaft.

The other function of shaft sleeves is to protect the shaft against the rubbing action of the packing where the shaft goes through the stuffing boxes. For the service both of the types of sleeves are satisfactory. In this connection, it might be mentioned, that a good deep stuffing box is better than a good shallow one. Some preference should be extended to the design that permits an additional ring or two of packing. Leakage through the stuffing box is controlled easier and the unit pressure on the sleeve is proportionately reduced.

### Wearing Rings

To avoid excessive internal leakage or by-passing of the fluid pumped, a small clearance must be retained between the pump casing and the hubs of the rotating impeller. Flow of the fluid through these internal passages is a cause of unavoidable wear. Most pumps are provided with replaceable casing or stationary wearing rings at these points which serve a double purpose. They protect the pump casing, and by replacement, permit the original clearances to be re-established with resultant maintenance of pump efficiency.

Pumps are often provided with a set of companion rings on the impeller hubs and they are intended to serve the same functions.

Divided opinions are prevalent among operating engineers as to the value of the impeller wearing rings. The casing rings are usually easy to remove and replace and are a good investment in any pump. On the other hand, impeller rings are often difficult to loosen from the impeller and removal may cause sufficient damage to the impeller to make a ring replacement impossible without a great deal of machining. For this reason, manufacturers often eliminate the impeller rings on the assumption that it is more practical to dress the impeller hubs after wear has occurred, and replace the original casing rings with oversize rings to establish the original clearances.

Wearing rings are usually designed with a straight passage between the concentric faces, but some manufacturers favor the labyrinth or step design. In these types, the leakage, in passing from the pressure region to the eye of the impeller, has a relatively longer travel than in the straight-through type. The resistance to flow, therefore, is increased in the labyrinth type and less leakage is supposed to be sustained for any given clearance. Likewise, for the same leakage, it is claimed that wider clearances may be used.

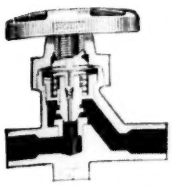
Theoretically, it would be difficult to disprove these claims, but it has been the writer's experience that in actual practice, pumps equipped with labyrinth wearing rings do not show higher efficiencies than pumps not so equipped, nor do they necessarily hold their original efficiencies over longer periods.

The engineer, in evaluating these features of a pump, should insist on casing or stationary wearing rings. But if the application entails no unusual features or troublesome fluids, he should manifest unwillingness to pay a premium price for a pump simply because it is equipped with impeller rings or rings of the labyrinth type.

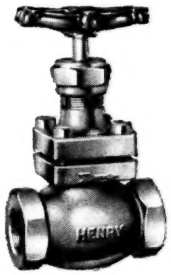
### Impellers and Casings

Impellers, even though the heart of the pump, seldom are a source of pump failure providing the pump is operated under proper suction conditions. When the pump suction connection is kept flooded under all conditions of operation to minimize cavitation, the impeller will give long continuous service. This assumes that the material of construction is suitable for the fluid pumped.

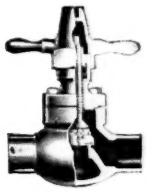
This may also be said for the pump casing. Practically the only requirement for long service is in the choice of a proper material for the fluid to be handled. One point of caution in this regard may not be amiss. Cast iron pipe generally has a satisfactory life for salt water lines, but cast iron pump parts will not stand up for this service. The surface film on an iron casting resists corrosion of salt water, but when this film is machined away, as it would do a pump casing or other parts, its service life is so reduced as to render it unsuitable.



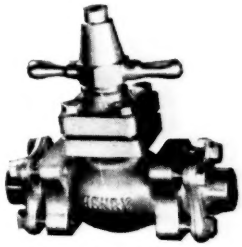
**PACKLESS VALVE**
With balanced-action



**AMMONIA VALVE**
Bolted Bonnet — screw or flanged connections. Also with screwed bonnet, sizes 1" and under



**WING CAP VALVE**
Non-ferrous



**WING CAP VALVE**
Semi-steel—with companion flanges and adapters

HENRY VALVE CO
CONTROLLING FLOW
SINCE 1910

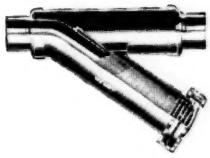
you pay—

for

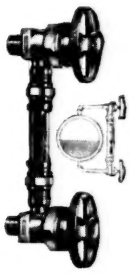
the extra advantages found in

or for the extra satisfaction that follows their use

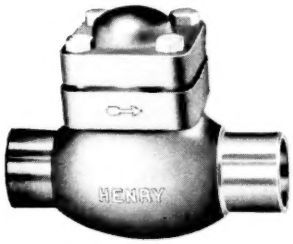
**STRAINER**
Angle type with patented distortion-proof flange



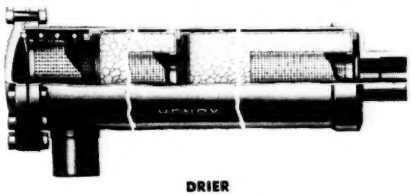
**Y-STRAINER**
Brass plated. Welded steel construction with forged brass connections. Size ⅝" O. D. S. through 4⅛" O. D. S.



**BALANCED-ACTION PACKLESS LIQUID LEVEL GAUGES**
Valves are backseating—diaphragms may be inspected or replaced without loss of liquid. Conforms with all safety code requirements.



**CHECK VALVE**
Piston Type For Freon. Sizes ⅞" through 4⅛" O.D S.



**DRIER**
Cartridge type with dispersion tube

**EXTRA CAPACITY DRIER**
2 cubic inches more than established practice. Forged brass end caps.

*. . . Write for these catalogs*

**No. 100** Packless and packed valves, strainers, driers, ammonia valves, check valves, relief valves, three-way valves, scale traps, liquid gauge sets, flange unions, nut unions and accessories for air conditioning and refrigeration and industrial uses.

**No. 70** Drop forged and cold rolled steel fittings.

**DIAPHRAGM RELIEF VALVE**
Large capacity—fast positive relief and reseating action. Very small differential between opening and closing pressures.

**STRAIGHT-THROUGH RELIEF VALVE**
Large capacity—All Brass Construction. Sizes ¼" M.P.T. through 1" F.P.T.

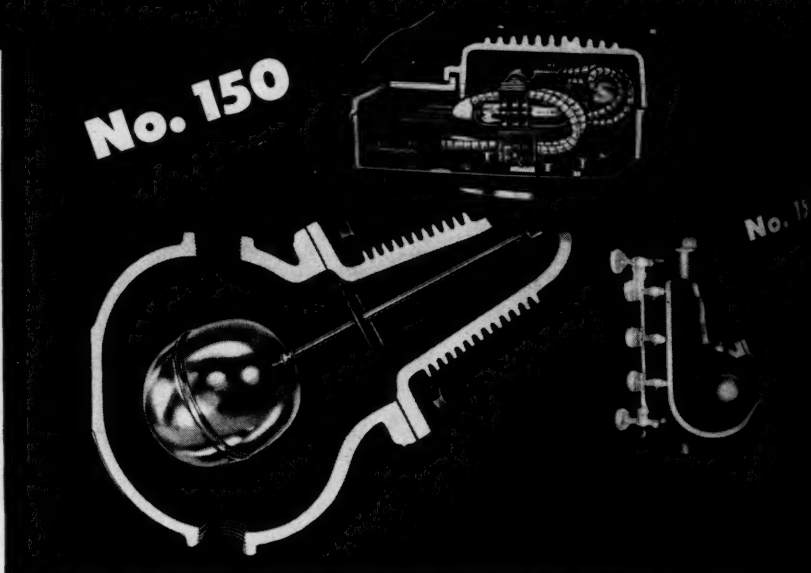
***Stocked and Sold by Leading Jobbers***

VALVES • DRIERS • STRAINERS • CONTROL DEVICES and ACCESSORIES FOR REFRIGERATION and AIR CONDITIONING and INDUSTRIAL APPLICATIONS

# HENRY VALVE COMPANY

MELROSE PARK, ILLINOIS (Chicago Suburb) • Cable: HEVALCO, MELROSE PARK, ILLINOIS

# What
## has done for high pressure boilers

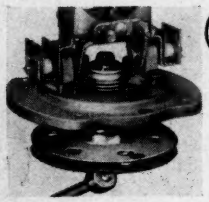



Water level control for the high pressure boiler is the toughest challenge of all to "Doing One Thing Well." To work dependably in this service a water level control must be engineered down to the last detail to stand up in the presence of high pressure and the high temperature that goes with it. You have such a control in the McDonnell No. 150. It has been developed through study of operating requirements in countless applications—a dependable basic unit that can be wired as a low water fuel cut-off, as a low water alarm switch, as a boiler feed-pump control, or for any combination of these uses. Here are some of the features that set it distinctly apart:

**For boilers with pressures up to 150 pounds**

### 1 Operating Parts Away From Heat

All operating parts are isolated from the steam and hot water zone. Radiating fins on housing help further to reduce temperature surrounding these parts.

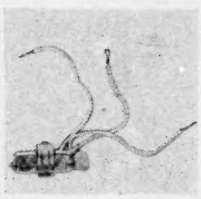


### 2 Completely Packless

Genuine Sylphon bellows, made of heavy Monel metal, totally eliminate packing. Sylphons have integral base plate so they can be clamped in place in a mechanical seal that never lets go.

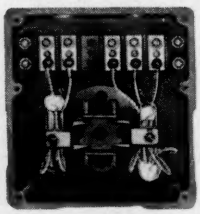
### 3 Heavy Welded Monel Float

Capable of withstanding pressures far beyond the rating of the No. 150, the float and rod are made of heavy monel metal, welded for maximum strength.



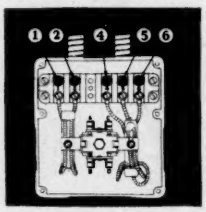
### 4 Porcelain Insulation on Lead Wires

Another typical refinement of the No. 150, this porcelain bead insulation is impervious to highest temperatures, yet provides ideal flexibility.



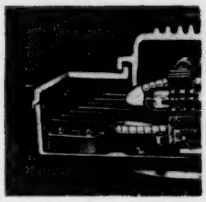
### 5 Dual "Multi-Purpose" Switches

Specially developed for high temperature service, the two heavy-duty mercury switches provide circuits for all purposes—for low water fuel cut-off, pump control, low water alarm switch, or any combination of these functions.



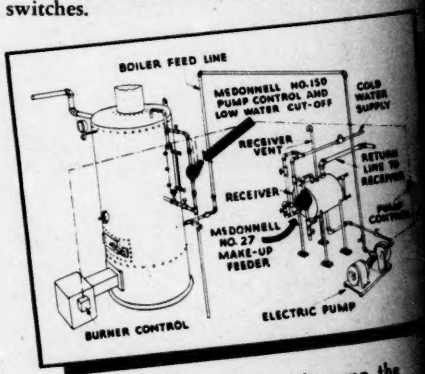

### 6 Easy To Wire

Easily identified and readily accessible terminals, in panel molded of high temperature phenolic, make wiring easy through two convenient conduit outlets.



### 7 Two-Piece Junction Box Cover

Provides access to terminal panel without exposing switches and leads. Main part of cover is factory sealed as a safeguard against tampering or accidental damage to switches.




McDonnell No. 150 controls pump the accepted best way—according to actual boiler requirements. Make-up feeder maintains adequate supply in receiver at all times. No. 150 can also be used for two or more boilers supplied by one feed pump; simple wiring diagrams are available.

**McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.**

*Doing One Thing Well*

Your Jobber Stocks Them

# McDONNELL